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RICE IN COLOMBIA: A CASE STUDY IN AGRICULTURAL DEVELOPMENT*

INTRODUCTION

The Republic of Colombia in northeastern South America, with a land area of 114 million hectares, is approximately as large as the total area of the six European Economic Community countries or the combined areas of New York, California, and Texas. It lies wholly within the tropics.

Three main mountain ranges, running generally northeasterly, dominate the country's topography (Map 1A). Some peaks run up to 17,000 feet in elevation. Climatic zones range from perpetual snow to the humid lowland areas of the Amazonian forest. Precipitation is equally varied. In a semidesert area in the northeast the yearly rainfall is only 13 inches, while on the Pacific coast is one of the rainiest tropical forests of the world where average annual rainfall is 394 inches, in some years reaching 748 inches. Half of the total area lies east of the easternmost chain of the Andes, the Cordillera Oriental. There the savannas of the Orinoco river basin are under extensive grazing, only their westernmost edge being tilled; to the south the jungles along rivers draining into the Amazon are mostly wilderness. Areas of unbroken rain wilderness also stretch along the Pacific coast, west of the Cordillera Occidental.

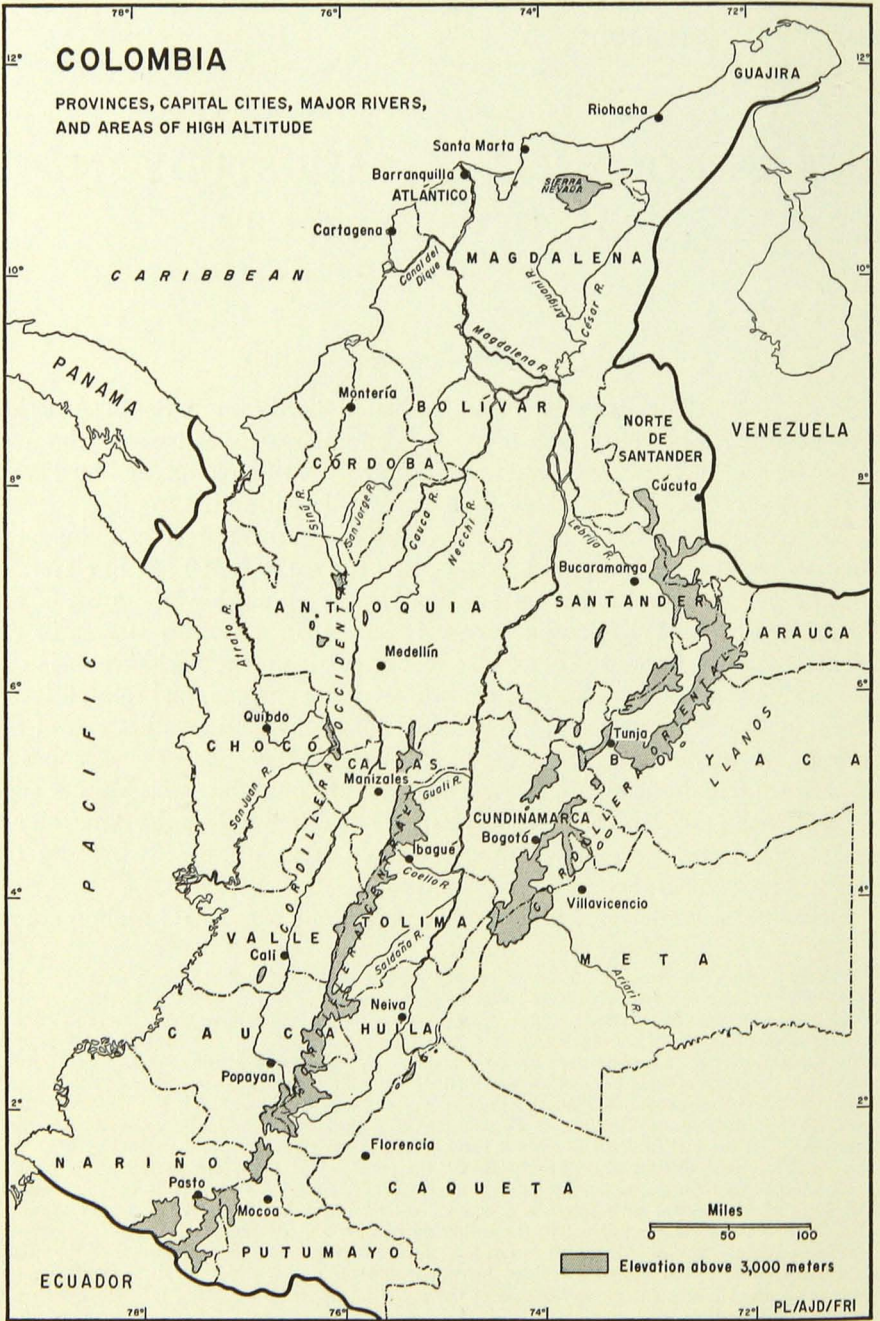
Only some 50 million hectares of Colombia's total area of 114 million are re-

* This is one of a group of studies of specific aspects of agricultural economic development in Colombia by a team of two German and two Belgian research associates and two German research assistants who served on the Food Research Institute staff from 1962 through 1965. Initiated and directed by Professor Karl Brandt, the project was financed primarily by the Institut Belge pour la Recherche Scientifique Outremer (IBERSOM), and the Fritz Thyssen Stiftung of Germany. Additional funds from the Rockefeller Foundation and the Ford Foundation made a year of field investigations in Colombia possible. Various agencies of the Colombian government, the Universidad del Valle, and the staff of the Rockefeller Foundation in Bogotá lent their good offices to assist the researchers. The original draft of this paper was completed early in 1965, and in general it has not been possible to take account of statistical data for the period since 1964. The present study had the benefit of contributions by many persons in governmental agencies and private organizations in Colombia. While they are too numerous to be cited their friendly help is hereby gratefully acknowledged. Miss Verena Stolcke assisted in the collection of data and documents in Bogotá.

Once again the author is indebted to Dr. Merrill K. Bennett for his skillful editing of the manuscript. Dr. Helen C. Farnsworth provided helpful comments on an earlier draft. Miss Rosamond Peirce gave valuable help in the preparation of the statistical materials and Mrs. Jane Dobervich prepared the charts and maps.

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MAP 1A



garded as developed. In 1959 the census (34, p. 25) recorded still less, 27 million hectares, as under agricultural exploitation, distributed as follows (*hectares*):

Annual field crops	1,953,000
Fallow	1,579,000
Permanent crops	1,515,000
Permanent pastures	14,605,000
Mountains and woodland	6,387,000
Other land—rivers, marshes, lagoons	1,298,000
Total	27,338,000

According to the census estimates the major field and tree crops of 1959 were grown on the following hectares:

Coffee	969,000	Manioc	217,000
Maize	871,000	Cotton	... ^a
Plantains	410,000	Wheat	130,000
Sugar cane	344,000	Potatoes	124,000
Rice	227,000	Beans	116,000

^a Not recorded.

The figures for field crops probably slightly overstate the facts because of double counting of fields harvested twice yearly. For example, double crops of paddy rice are common in most of the settled areas of the country.

Such figures suggest clearly that Colombia is a country with a vast expanse of potentially productive land, of which part is intensively utilized, much more is extensively pastured, and the larger remainder is essentially wilderness. Not more than 3.5 million hectares are utilized for the annual field crops and permanent crops that provide the vegetable foods for the Colombian population and the nation's chief exports. In addition to abundance of land there is an abundant supply of labor and wages are relatively low.

Notwithstanding favorable natural conditions, the production of agricultural commodities has not expanded rapidly enough to meet the growing demands of an expanding population. Typical patterns appear in the evolution of agricultural production, influenced by abundance of land but high cost of capital and implements. High rates of profit seem to be within easy reach when new opportunities are opened by such external factors as an increase in foreign demand, the introduction of a policy of self-sufficiency, and the extension of the road network. A boom in crop production develops in one place or another in an atmosphere of contagious optimism. People move in, large stretches of new land are planted, and output increases. Then comes a second phase. Concentration of production in areas where there is no cold season of dormant vegetation provides breeding grounds for parasites, insects, weeds, and fungi; monoculture tends to deplete specific plant nutrients in the soils; seeds introduced from abroad may degenerate. Attractive prices often do not last long. Rates of net income on farms decrease gradually; enthusiasm for expansion of output fades; and the farmers migrate or turn to the production of other commodities.

This pattern of alternate boom and decline has often been observed in Colombian agriculture. In the rice industry, however, a third phase has followed one of recovery, with massive application of improved inputs and methods, leading to considerable progress.

The first and second phases developed as expected. Official support in the beginning temporarily brought high rates of profit, attracting capital and entrepreneurs to the paddy fields; and growth followed automatically. After a few years, however, yields per unit of land fell as weeds proliferated, soil fertility was reduced, and many fields became salinized. Profit margins moved downward from 1950 to 1960, and some paddies were turned back to pasture. Several of the more enterprising growers, however, joined together to seek better methods of rice production that would restore yields and lower costs, partly because they realized that there was no equally satisfactory alternative use for their land. They actively strengthened and guided the policy of the National Federation of Rice Growers toward many modern improvements in farming methods and the restoration of profits in key areas. Of course, some rice belts that did not participate actively in the initiation of modernization nevertheless benefited from these improvements.

The story will be told here under two major topics. First is a discussion of the factors responsible for the profound changes in the postwar period. Second is an "exposé" of the impact of those factors in major areas of varying ecological and institutional conditions.

THE INCREASING IMPORTANCE OF RICE IN THE COLOMBIAN FOOD ECONOMY

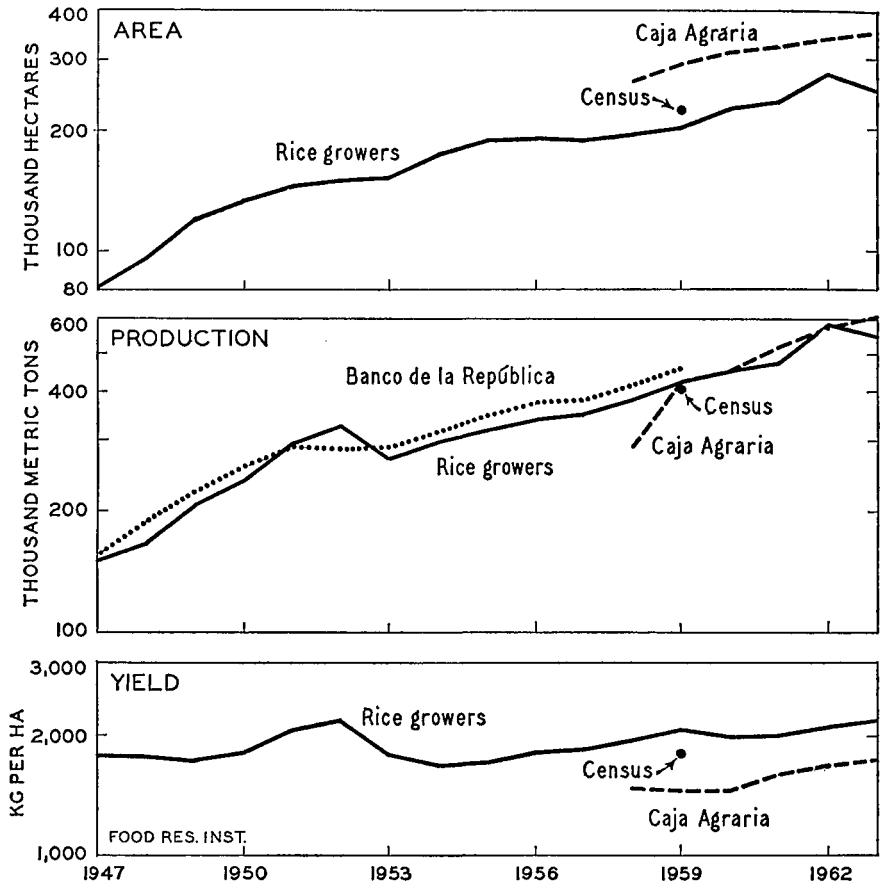
Rice production estimates for Colombia have improved greatly over the past 30 years (see Appendix I). Although they are by no means fully reliable as yet, particularly for the production of upland and swamp rice,¹ they give a fairly good idea of recent trends in production. While of more uncertain quality than the corresponding estimates for cotton or centrifugal sugar—commodities industrially processed, as rice is—they are certainly much better than for the typical products grown by small farmers for their own consumption, such as maize, potatoes, beans, and sugar cane used for *panela*. For rice, as for other industrially processed crops, the best available production figures are considerably more trustworthy than the estimates of area and yield. Estimates of production, area, and yield are summarized in Chart 1.

Imprecise as they are, available production data clearly indicate the growing importance of rice in the Colombian economy. Whereas in 1940 rice played a secondary role, it had risen by 1963 to high rank in the value of production of marketed foodstuffs and was one of the main components of many Colombian diets (see Appendix Table III).

Although several differing estimates of food consumption are available for Colombia, they have so tenuous a basis and are so conflicting that few generalizations can safely be derived from them. On the whole, it seems probable that since World War II rice has risen in consumption more rapidly than any other vegetable food. The diverse estimates also agree in suggesting that rice has recently ranked only below sugar and maize as a source of food calories for the country as a whole, though there are striking differences in the consumption patterns of different regions and different income classes. And Colombia has recently pro-

¹ Colombia produces rice that is irrigated in paddy fields under controlled water supply; swamp rice that is planted along river banks before the rivers flood and harvested after their subsidence; and upland or mountain rice that depends solely on rainfall.

CHART 1.—RICE AREA, PRODUCTION, AND YIELD IN COLOMBIA, 1947-63, ACCORDING TO SEVERAL SOURCES*



* Data are presumably for the whole country except the census figures for 1959 (see below); production and yield are rough rice basis.

Rice growers: data of the National Federation of Rice Growers, mainly unpublished, but see note for production on Chart 2. Recently the FAO has adopted Rice Growers figures for all years from 1947, having received these from a representative of the Colombian government. Figures published in the earlier FAO *Yearbooks of Food and Agricultural Statistics* differed considerably, specifically for 1947-52 and 1956.

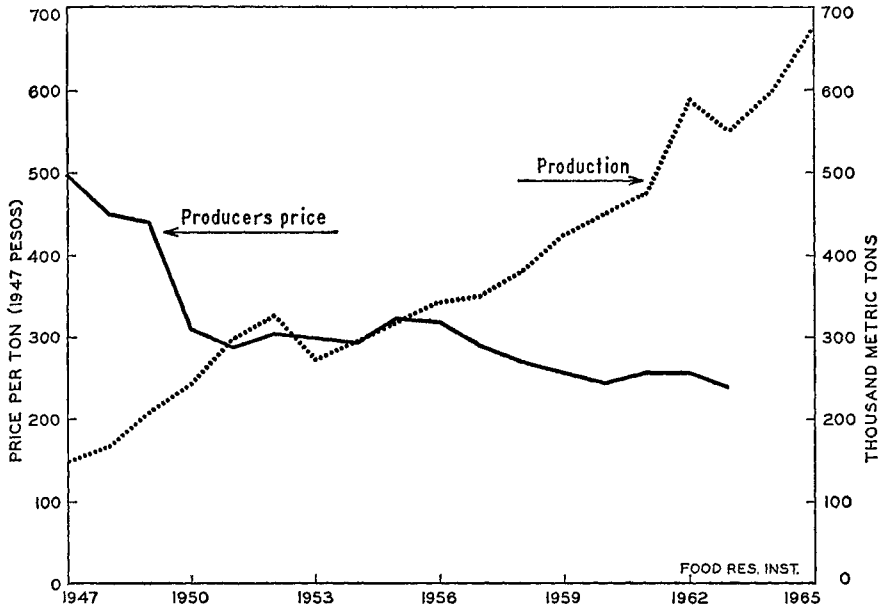
Caja de Crédito Agrario, Departamento de Investigaciones Economicas, "Anexo calculos de produccion agricola, de 1958 a 1963," *Carta Agraria*, No. 144, September 1964.

Census: Colombia, Departamento Administrativo Nacional de Estadística (DANE), *Directorio nacional de explotaciones agropecuarias (censo agropecuario), 1960—Resumen nacional (segunda parte)* (Bogotá, 1964). The census gives no data for Choco, Caqueta, Guajira, and "others" as reported by the National Federation of Rice Growers. Rice Growers data for 1959 for the departments included in the census are as follows: area 190,000 hectares, production 390,000 tons, and yield 2,048 kilograms per hectare.

Data of the Banco de la República for 1947-49 from its *Statistical Survey of the Economy of Colombia* (Bogotá, 1960), p. 27; for 1950-59 provided by the Ministerio de Agricultura in 1961.

duced a small exportable surplus of rice, whereas maize production has often been insufficient; and about half of the wheat is imported. Only centrifugal sugar and rice, the two crops grown principally under irrigation, produced a surplus for export.

CHART 2.—ROUGH RICE: PRODUCTION AND PRICES RECEIVED BY PRODUCERS, 1947-65*



* Production data of the National Rice Growers Federation (FNA) for 1947-60 are from *Arroz*, Vol. IX, No. 105 (Bogotá, 1960), for 1961-65 from *ibid.*, Vol. XV, No. 165 (Bogotá, 1966). Prices, based on FNA records of selling prices of affiliates (mainly growers of irrigated Bluebonnet in the central zone and Meta), have been deflated by the price index for 15 foodstuffs from *Revista del Banco de la República*, shown in Appendix Table V, here converted to 1947 = 100.

Between 1947 and 1965 there was a more than fourfold increase in the production of rice in Colombia. The increase in output was paralleled by a downward trend in producers' prices, the contrast being especially marked in the period 1957 through 1963 (Chart 2). Three different periods are to be distinguished. Until 1951 real prices were falling and production was increasing rapidly. The price-support policy then pursued, and the closing of frontiers to private imports, attracted capital and entrepreneurs from the cities to the countryside. From 1951 to 1956, price and production were stable. Production was restrained through natural causes—take-over by the inferior, pest resistant, red rice, invasion of weeds, and lowering of natural fertility. But expansion of rice growing in new areas, notably in new irrigation projects planned around 1945, offset lower yields in the older belts. Since 1957, production has increased sharply, even though producers' prices have fallen—a sign of genuine progress.

In 1960, the retail price of rice in Colombia was about two-thirds of the price-supported retail price in the United States, although it was double the CIF European price for Thai rice (72). This relationship reflected the effectiveness of Colombian official support of domestic rice prices, partly as compensation for the burden on Colombian farmers of a high level of protectionism on machinery, fertilizers, pesticides, and other inputs.

A quite different pattern developed in the production of maize, the most important grain in Colombia and a potential competitor for rice lands. Maize is one of the main crops of peasants and small farmers. The establishment of a

plant in the mid-1950's for the production of maize oil and starch and the expanded use of maize in poultry feed encouraged some large farmers to produce it as a commercial crop. But unlike rice, maize was not accorded effective price controls to attract large numbers to maize production. Expansion of production of maize did not keep up with the demand, as evidenced by imports in 1964 and by difficulties in getting the necessary supplies for the industrial plants. Notwithstanding the notorious imprecision of production statistics for maize, the general view is that total availability of maize has not increased in the last 20 years, a time of expansion of industrial uses and of population. Part of the food needs have been filled by an increase in rice production. All available evidence, while admittedly deficient in quality, points in the same direction. Gross production of rice shows the highest postwar rate of increase among the significant food crops grown mostly for national consumption.

In 1964 the total value of rice production was exceeded only by the value of sugar in all its forms, by maize, and by the exported coffee which ranked first by a considerable margin. Rice has become a primary staple food in the tropical and subtropical regions and also in the large cities. The problem is to determine the factors that account for the progress of the rice industry and to trace the effects of this progress upon regional economies. Study of these factors may offer some insight into the long-term effects of policy measures applied to agriculture in underdeveloped countries.

DEVELOPMENTS BEFORE WORLD WAR II

Although the spectacular increase in rice output came only in the last quarter century, some of the basic changes that contributed to this growth, such as the introduction of rice into Tolima several centuries ago, the opening of new areas to rice cultivation, and the expansion of rice trade, took place before 1940.

Rice was grown in Colombia as early as the sixteenth century. In the province of Mariquita, now the northern part of the department of Tolima, an abundance of upland rice was produced as early as 1580. Methods of cultivation were the same as those used for wheat. Farther north in the Magdalena Valley, maize and upland rice were broadcast on the same fields (110).

Since the time of the Spanish conquest in the first half of the sixteenth century, rice has become one of the staple foods in hot and wet parts of the country. Settlers who cleared the land grew mountain rice as their first crop. In northern Colombia this was fostered by a system of land utilization which was common. Beef ranchers who had to fight persistently the regrowth of natural forests signed contracts with small farmers for their pasture land, and in return the farmers received for their individual use two hectares of land for a period of two years. After clearing with fire and axe, they grew three crops and then planted grass so as to return the land to the owners as pasture.² West of the Magdalena River, this system of land utilization accounted for another significant part of the rice production.

Rice is so bulky that its development as a commercial crop has depended

² This system existed in the department of Magdalena up to 1950. In 1948, most of the food crops grown there were produced under this capital-saving land utilization system, advantageous to both parties. During that year an estimated 79,000 hectares of seasonal crops were grown in this way, compared to 3.5 million hectares in pasture (99, pp. 2-3).

largely on the availability of cheap means of transport and convenient milling facilities. It was availability of cheap transport along with favorable natural conditions that contributed to an early start of the rice industry in the departments of Bolívar, Córdoba, and Antioquia (Map 1A). In this large area, on the banks of the Sinú, Cauca, Necchi, and San Jorge rivers, the main part of Colombian rice was produced, mostly swamp rice. These three departments accounted for half of the national rice production in 1934 (97, p. 18). The large surpluses were put in river boats (often owned by immigrant Syrian and Lebanese traders) and sent down river to Magangué, Barranquilla, and Cartagena to provide part of the basic diet of the urban population.

The success of swamp rice depends essentially on natural conditions. Raids by birds, a major problem, cannot be avoided during their seasonal migration by shifting the seeding time, as is possible with irrigated rice. Protection against birds may sometimes account for as much as one-third (101, p. 14) to one-fourth (114, p. 13) of production costs. Variations in rainfall determine the success in growing mountain or upland rice, and time, magnitude, and duration of flooding determine the yield of a field of swamp rice on the banks of a river. With too short a flooding period the rice stops growing; mice and rats attack what is left. With high floods the rice is drowned; with too long a flooding period the harvest is jeopardized.

On the Pacific coast of Colombia after 1931, some impetus to rice production in the department of Chocó (81, p. 22) was given by an improved transport system by boat and establishment of a dozen small rice mills by the Colombian government. In this region, as in Ecuador, the waters rise and recede twice a day on the alluvial soils, according to the tide. The incoming tide drives back the fresh water of the rivers, so that ten to fifteen miles inland the water overflows into irrigation basins. This also provides natural fertilization. Exploitation of this extremely favorable natural environment, which explains the prosperity of Ecuadorian rice growers, has not yet been greatly stressed by Colombian growers.

The role played by marketing and milling facilities in development of the rice industry is clearly evident east of the Andes, in the eastern Llanos that have only recently been opened to trade. Rice was there a staple food for cowboys in the nineteenth century. Once or twice a year the cattle were rounded up to be checked and moved to market; a large enclosure of about a hectare was built, and the cattle confined there grazed off every bit of grass and fertilized the soil well with urine and manure. Once the animals had left, rice was sown on the land, and extraordinarily high yields were obtained. Often, however, much of the crop was left unharvested because of the lack of marketing facilities.⁸

Commercial production of rice in the Llanos for the Bogotá market began in 1906, when General Rafael Reyes, the President of Colombia, decided to clear Bogotá of all beggars, thieves, and prostitutes "from the upper as well as the lower level." He sent them for "reeducation" to establishments east of the Cordillera Oriental. One of these penitentiaries, "La Colonia," now Restrepo, was in charge of an officer who was deeply interested in agriculture. He put inmates to work

⁸ Around 1870, travelers reported that farms of the Apiay savanna kept 50 to 100 animals in a one-hectare enclosure once a year for 20 to 30 nights. Then rice was sown and average yields were said to be 150 times the seed used. Second and third harvests, without additional effort, gave yields 30 to 40 times the amount of seed (119).

cutting trees, burning weeds, and planting. They grew rice successfully, and transported surplus production to Bogotá by mule. But it was difficult to mill rice without appropriate machinery and on that account production is said to have remained at a low level, around 62.5 tons per year (81, p. 20).

In 1912, two businessmen from Bogotá perceived an opportunity and sent a small hydroelectric plant and a rice mill by mule eastward to Colonia (Map 1B). Although transportation took one year and cost three times the price of the plant in Bogotá, production increased rapidly and the mill was working at a capacity of 4.8 tons per day by 1914. As early as 1916 a second plant was successfully established in Villavicencio (135). Increasing more or less steadily thereafter, rice production in the Llanos reached a level of 12,000 tons in the 1940's.

Cultivation of irrigated rice in regions unfit for upland rice is about a century old. In Guacarí, on the western slopes of the Cordillera Central, just west of "El Paraíso," where Jorge Isaacs wrote his romantic novel *La María*, rice production developed in the middle of the nineteenth century. Rainfall was too low and unpredictable for upland rice, but water was available from streams all year round, and land had no scarcity value, for this was cattle country with a relatively low density of population. Capital was very expensive. The system of rice production which was introduced combined these factors most economically. The field was flooded, and cattle were then brought in for a few days to transform the ground into a muddy slough. Rice was then sown by hand and the field was irrigated regularly by spreading water through it (gravity-flow irrigation) until the grain was ripe. Weeding was done by hand, by teams (*cuadrillas*) of laborers. At harvest the rice was cut with a machete, threshed with a flail, and finally de-husked and hulled with the aid of wooden mortars.

The custom of cropping the same field twice or more by the so-called *soca* method dates back to the time when rice was first introduced in this area. As soon as the field was harvested, cattle were brought in and kept there about two weeks. They grazed off weeds and remaining vegetation and trampled the fallen rice seeds into the ground. Teams of farm laborers cleared the last remnants of weeds and cut the rice straw. Water was poured in, the trampled-in seed sprouted, and four months later the field could be harvested for the second time and so on for the third, fourth, even fifth and sixth times, after which the quality of the rice was so poor and the growth of weeds and parasites so overwhelming that the field had to be freshly seeded (95).

New implements for rice cultivation were gradually introduced in the Cauca Valley such as the hand plow, the metal plow, the steam threshing machine, etc. In 1927, food prices were pushed up by high coffee prices and expenditure of funds received from the United States as indemnification for the separation of Panama. In order to prevent inflation the government, conservative at the time, decreed free importation of commodities. This was a hard blow to commercial agriculture. Rice growing in the Valle, the unique irrigated region, was affected most. Even the Japanese immigrants, despite their skills, were unable to make a living from rice in 1929 (127).

In 1930 a liberal government came into power, created the Agrarian Bank, and abolished the emergency protective decree in order to restore prosperity in the backlands. Reinstated tariffs on commodities in 1931 brought about a certain

increase in production. The "modern" rice industry in Valle regained its former importance, and in 1934 produced as much as one-ninth of the national total (97, p. 18).

In Campoalegre in Huila department, cultivation of irrigated rice began about 50 years ago. The first man to grow rice there was from Bogotá, a son-in-law of the largest landowner in Campoalegre; he was soon imitated by the shrewder local people. Since then, the department of Huila has maintained leadership in the field of rice technology.

In Mariquita in Tolima department, where Spaniards grew rice to supply Bogotá in 1580, other Spaniards introduced modern irrigation methods in 1933. In this dry, hot savanna, today only four hours from Bogotá by automobile, land was worth little. It sold for 10 pesos per hectare and could be leased for 0.25 pesos per hectare. Spaniards built a canal irrigation system with excellent results. Others joined in, and the government built more irrigation canals, connecting them with the Guali River. Between 1933 and 1948 land values rose from 10 to 300 pesos per hectare. Rentals multiplied 160 times, from 0.25 to 40 pesos (110). (In terms of deflated values, land increased 10 times and rentals 50 times.) Unfortunately, the waters of the Guali River contained sulphur salts, and after the end of World War II, rice production in that area suffered a setback (56, p. 6).

In view of the Spaniards' success, attempts at irrigation were made all over Tolima. In Alvarado, south of Mariquita, one large farmer (56, p. 7) became an "apostle of rice"; he showed his farm to anyone interested, explained rice cultivation techniques with irrigation, and distributed free seed.

In central Tolima, another large farmer tried rice cultivation in the area between the Magdalena and the Saldaña rivers, where it appeared possible to irrigate by gravity (an area now covered by the Saldaña irrigation project). Although a first canal was built, the project proved somewhat unsatisfactory; up-to-date machinery was yet to be introduced and marketing was still unorganized. Pasture therefore continued to give the best economic results (94, p. 6).

Around 1936-37, the "rice fever" spread from Mariquita south to the Llanos of the Ibagué high plain (mesa), a dry, scarcely cultivated area just east of the Cordillera Central, where 8 to 10 hectares were required to support one cow. As in Mariquita the value of land was 10 pesos per hectare. But the creeks that flow down the mountain sides, can be made to feed canals and thus create a series of irrigated fields, each field watered by a separate creek—all at an elevation of 1,100 to 1,200 meters. The first rice field was planted in El Salado (Tolima department), 10 kilometers from Ibagué. Soon thereafter the dry, parched land along the Ibagué, Honda, and La Dorada roads was punctuated with green spots of rice fields.

The low price of land was a major reason for the development of rice in this high plain country. At the outset owners were happy to sell land at 15 to 20 pesos per hectare, which was twice the usual price, but as prices rose they preferred to lease their land at quite high rentals. The rents amounted to about one-fourth, and for the best land to as much as half, the value of gross production (56, p. 9). Even so, the favorable economic conditions attracted people from the cities, including intellectuals and bureaucrats, who knew nothing about agriculture and yet did not fail. With their relatively progressive background, these people im-

proved techniques with unusual rapidity. The new producers, ignoring the traditional methods of cultivation, preferred to take the counsel of specialists, the agronomists. Thus it was possible to introduce *crotalaria* as a green manure crop and cottonseed and sesame cake as organic fertilizers. However, as the years passed the adoption of new techniques became more difficult (56, p. 13). On the eve of World War II, therefore, a growing though still a small part of the country's rice supply was produced under irrigation on the farms of Tolima. Output grew from 4 per cent of total national production, in 1934 to 6 per cent in 1938. This development was favored by lack of economic alternatives and by the conditions of the area, as well as by the openmindedness of the new rice growers towards technical innovation in rice culture. The sustained success of rice growing in that area, despite the classical emergence of the obstacles characteristic of tropical climates, is one of the most interesting aspects of the development of the Colombian rice industry.

GROWING IMPORTANCE OF GOVERNMENT ACTION

Long before World War II there was considerable government interference in the rice industry. Major examples of interventionist policy are the introduction of the Ley de Emergencia, its abolishment in 1931, the establishment of the Caja de Crédito Agrario, Industrial, y Minero, and the organization of rice campaigns.

After 1945 government action increased and decisively influenced the pattern of development of rice growing and marketing. Large investments in transportation vastly changed the regional pattern of production. As government interests shifted, more and more credits were granted for the products that seemed most profitable.

In 1944, a new marketing organization, the National Institute of Supply (*Instituto Nacional de Abastecimientos*, INA) was created and gained increasing importance. It has been financed partly by proceeds from the monopoly held for agricultural imports, particularly those subsidized by the United States under Public Law 480 since the mid-1950's. Many of the measures taken by the INA had only partial success or were not carried out completely. But for rice a somewhat more sustained line of action was pursued by another organization of increasing influence, the National Federation of Rice Growers (*Federación Nacional de Arroceros*), organized in 1950. This organization substituted a firm policy for the previously erratic government action.

Geographical shifts in the pattern of upland rice cultivation were largely due to improvements in transportation. In the decade 1952-62 approximately one billion dollars, one-fourth of the total national investment, both private and public, went for transportation (106, p. 10). The main improvement in land transport was road construction under a program (*el Plan Vial*) designed by experts of the International Bank for Reconstruction and Development and financed by it with long-term loans totaling 86.35 million dollars in the years 1953, 1956, and 1961 (106, pp. 24-25). Better highways, some newly paved, permitted truck transportation to compete for freight moved by air.⁴ This occurred particularly in the region between the eastern Llanos and Bogotá, and in the area around Medellín (106,

⁴ The volume transported by air between 1956 and 1961 decreased by 25 per cent in ton-kilometers, as a consequence of the improved movement of goods and passengers on roads.

p. 106). In 1962 about 60 to 65 per cent of the agricultural produce was transported by truck, 30 per cent by rail, and the remainder by riverboat or air (106, p. 139).

This enormous progress directly influenced rice growing. In the eastern and northern Llanos a noticeable shift occurred from cattle grazing and crop farming under extremely primitive conditions to modern types of farming. More efficient land utilization became possible; low-yielding lines of production moved to the frontier. As soon as a new road into the forest was opened settlers moved in, cleared land with fire and axe and planted mountain rice. Maps 2A and 2B showing the changes in the geographical distribution of rice in those regions gives a good picture of the progress of colonization. Comparison of the distribution of acreages of upland rice in 1932 and in 1959 reveals the advance of pioneers into the forests of Territorio Vasquez, the Río Lebrija area, and the central regions of southern Córdoba. On the other hand, the increasing value of land eliminated upland rice in the central areas; this development is quite evident in Tolima department, where 3, 157 hectares were grown in 1932, approximately 1,700 in 1948, and only 500 in 1962.

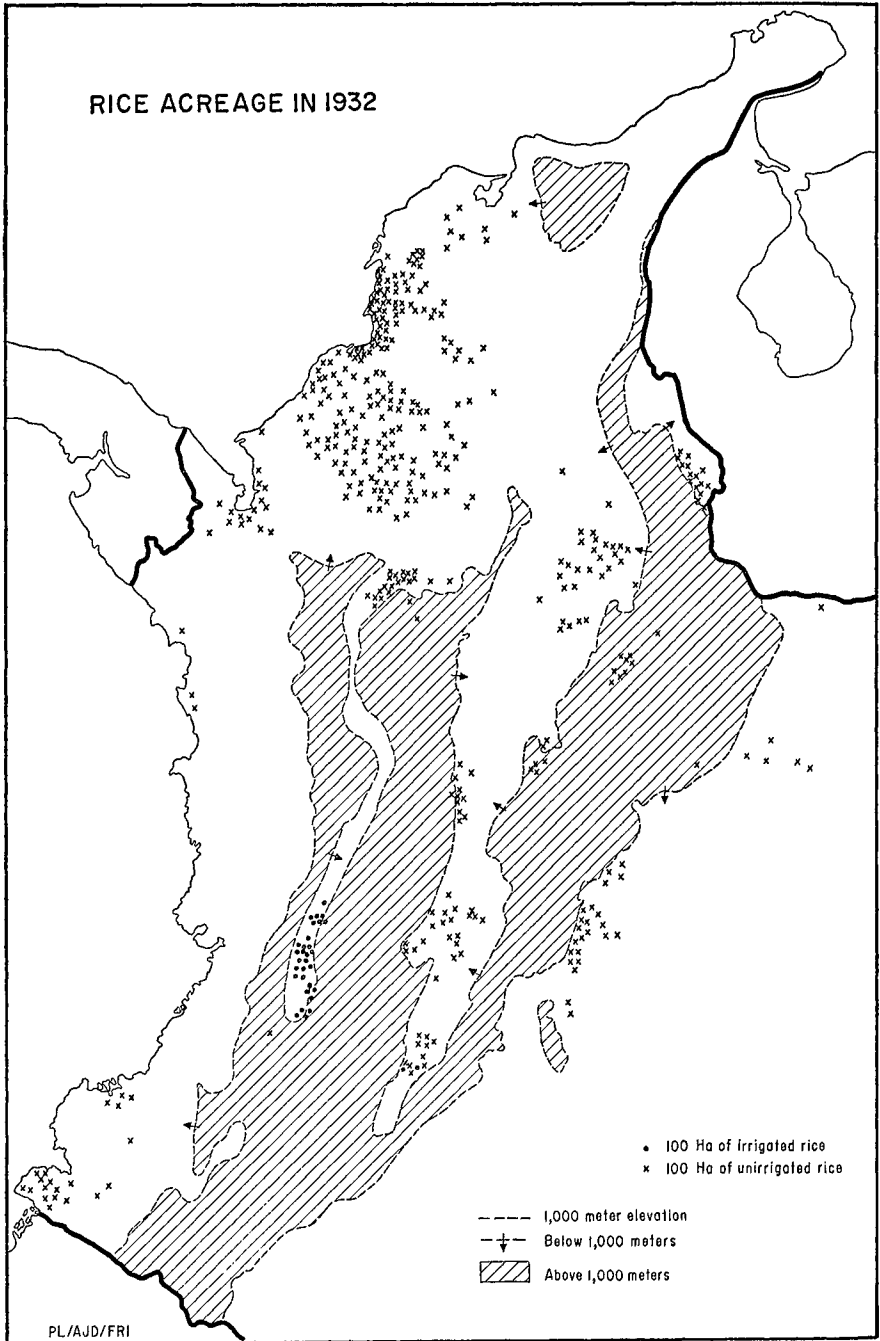
Other factors have specifically affected agriculture, one of the more significant being the increased protection against foreign competition in the national market of Colombia. Before World War II imports of rice consistently exceeded exports (Table 1) despite import duties. Differences in qualities and local and seasonal deficits or gluts accounted for adjustments in international trade movements. The war reduced sea transport and imports to a minimum. After the war, rising export prices temporarily opened new markets to Colombian rice production. However, discriminatory price policy began to discourage farmers and in 1947 Colombia again became an importer. In that year the National Federation of Rice

TABLE 1.—IMPORTS AND EXPORTS OF MILLED RICE, COLOMBIA, 1934–63*
(Metric tons)

Year	Imports	Exports	Year	Imports	Exports
1934	8,210	—	1949	69	1,501
1935	9,519	745	1950	1,142	469
1936	12,138	4,154	1951	7,402	—
1937	11,628	1,647	1952	27	7,853
1938	11,813	1,895	1953	98	18,700
1939	22,218	—	1954	31,369	191
1940	9,445	—	1955	2,155	—
1941	159	—	1956	—	—
1942	24	760	1957	10,239	2
1943	26	105	1958	24	—
1944	32	58	1959	284	—
1945	19	145	1960	157	—
1946	467	6,431	1961	39,141	—
1947	6,102	—	1962	2,739	4,191
1948	1,744	—	1963	48	3,137
			1964	223	160

* Data for 1934–45 from Ernesto R. Ramirez, *Estudio económico estadístico del arroz en Colombia* (Colombia, Ministerio de Agricultura, Sección de Economía Agrícola, 1953, mimeographed); for 1946–63 from Colombia, Departamento Administrativo Nacional de Estadística, *Anuario de comercio Exterior*, 1946–64 issues.

MAP 2A.—LOCATION OF RICE CULTIVATION IN COLOMBIA, 1932*



* Based on Colombia, Ministerio de Agricultura y Comercio, *Memoria del Ministerio de Agricultura y Comercio al Congreso Nacional en sus sesiones ordinarias de 1934*, Tomo III (Bogotá 1934).

Growers succeeded in influencing the government to cancel an import license for as many as 50,000 bags of rice and to eliminate price controls. There was a boom in rice prices, which stimulated production and gave rise to a new surplus at the end of 1948.

Production and consumption of rice thereafter increased at approximately the same rates. In 1951, following the expansion of irrigated areas, surpluses were produced and exported in 1952 and 1953, but there was a deficit in 1954. In 1957 a substantial part of the irrigated crop was destroyed by the virus disease *hoja blanca*, and the expected surplus was not produced; imports were substantial.

The government alternately subsidized rice exports to relieve producers and prohibited exports to relieve consumers. In August 1952, for instance, rice exports, which had been prohibited, were once more permitted. At the same time the Colombian Railways lowered their rates 20 per cent on transport of rice intended for export (19, p. 13). But in 1959, the rice harvest was below expectations as a consequence of insufficient price supports, better prices for other crops, and an increase in production costs; and in order to protect consumers, the government prohibited exports. Then again when in 1962 the National Institute of Supply did not know how to cope with the surpluses, export of 40,000 tons of rice was authorized under special terms (52), and about a tenth of that amount was actually exported.

The government's regulation of foreign trade hardly served to stabilize prices. The available statistics were unreliable. Production of surpluses in one region led to authorization of exports, while deficits in another area brought about imports. Thus in 1951 the National Federation of Rice Growers was authorized to export 750 tons of rice to Germany from Valle, but shortly thereafter measures were hastily taken to import rice to counteract soaring prices (50, p. 11).

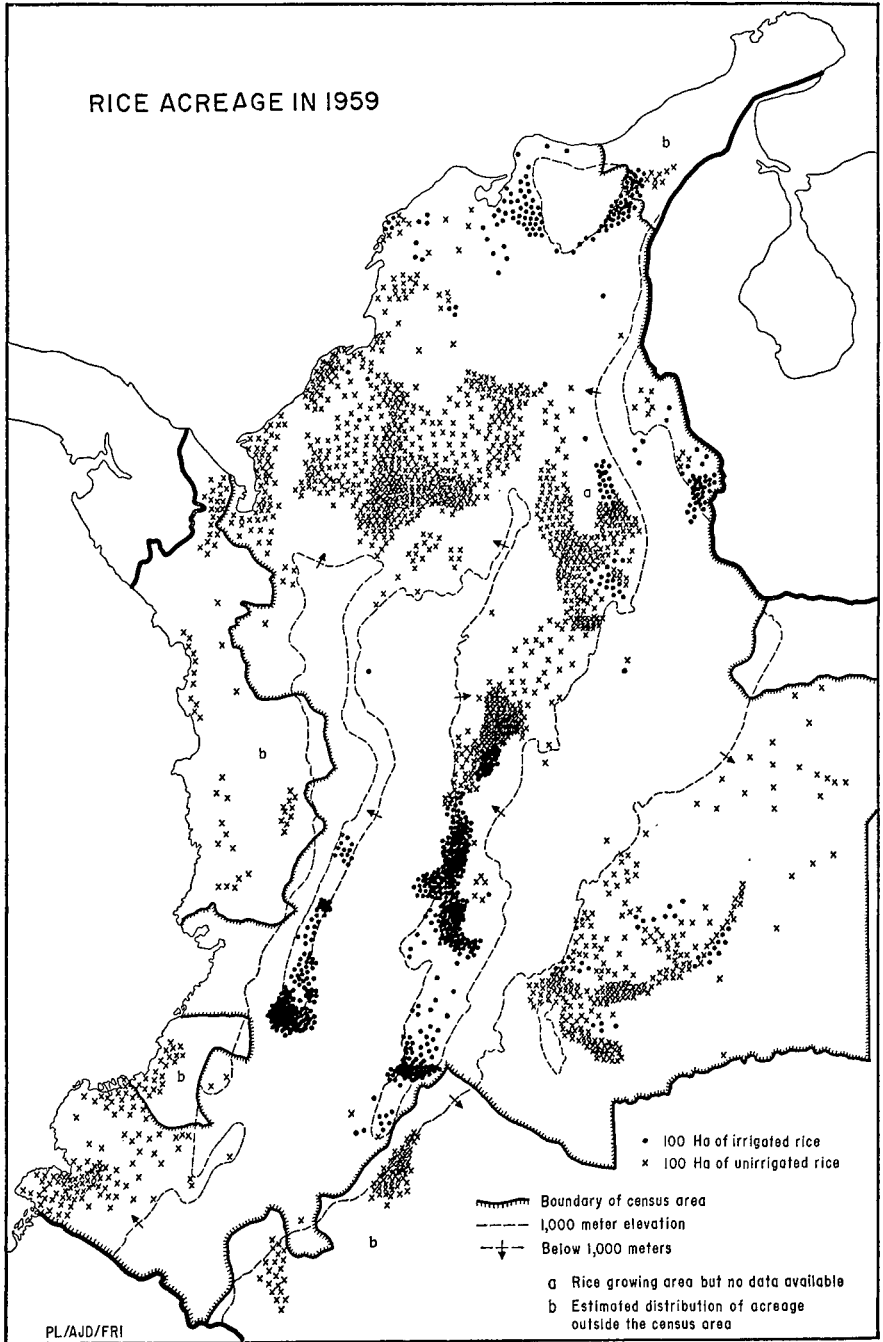
In 1961, the National Institute of Supply imported 34,326 metric tons. Unfortunately this "urgent" import was delayed and arrived at the time of a bumper crop. Prices fell and the Institute was forced to store the imported rice and buy rice offered by the farmers.

Smuggling is rather common and compensates in some degree for the rigidity of customs regulations. According to statistics of 1952, rice was produced above 10,000 feet in one *municipio* on the Altiplano of Nariño, the department bordering Ecuador, where temperatures are too low for rice production. This inconsistency surprised no one; evidently smuggled Ecuadorian rice was "nationalized" in this way (87, p. 3). In the same area, between April and December 1961, 20,000 tons of milled rice alone were smuggled from Ecuador by way of the road connecting Nariño with the center of the country (55). This is particularly striking if one considers that this road has control posts (*retenes*) every twenty miles or so.⁵

Despite vacillations and drawbacks, and probably largely in consequence of its erratic nature, protectionism of the Colombian rice industry brought significant results. High margins of profit in rice growing in the early 1950's attracted capital and urban skills. Once irrigation systems were developed, the areas sought

⁵ Similarly an upward trend in the agricultural sector of North Santander resulting from smuggling into Venezuela shows a strange parallelism to the price relationship between the bolívar and the peso.

MAP 2B.—LOCATION OF RICE CULTIVATION IN COLOMBIA, 1959*



* Acreage shown within the census area is based on data from: Colombia, Departamento Administrativo Nacional de Estadística, Directorio Nacional de Explotaciones Agropecuarias, *Censo Agropecuario*, Vol. 1, 1960, for Departamento de Cundinamarca; *ibid.*, Vol. II, for Departamento

protection against decline in land value resulting from lower returns. Rentals remained high, and since few alternative crops existed, at least in some areas, farmers felt pressure to improve methods and techniques. As previously noted, production increased approximately 300 per cent although prices declined (Chart 1, p. 222). Such developments probably could not have been achieved by protectionism alone, or without any protectionism at all.

After 1944 the National Supply Institute was responsible for stabilization of food commodity prices. The initial objectives of INA appear in a report prepared by a member of an American Agricultural Mission of 1944 in Colombia. The first step in the plan to stabilize prices of farm foodstuffs was to build maize elevators in Barranquilla, Bogotá, and Girardot respectively, but these were not completed until 1954.

In the meantime INA, which had "charge of defending the interests of both producers and consumers," devoted its resources to a wide range of tasks. As an official organization it was granted import privileges which became an important source of funds. INA imported such products as barbed wire, cement, trucks, caviar, sardines, Quaker oats, dehydrated soups, soybean oil, wheat meal, rice, and maize between 1945 and 1951. To businessmen INA seemed more like an import-export organization competing with private trade than an institution aiming to aid agriculture (67, pp. 197-98). This government intervention by INA extended into other spheres of the economy: in 1951 INA participated in the construction of a slaughterhouse in Valledupar in order to protect the income of cattle farmers affected by the prohibition of beef exports to the Venezuelan market (40); after devaluation of the peso in December 1962, the government used INA to influence retail prices, setting up a system of government-licensed retail stores to sell food provided by INA at below-market prices.

In principle INA has two basic functions: first, to monopolize imports of food commodities, and second, to stabilize producer prices of five major agricultural crops—maize, rice, beans, potatoes, and wheat. Stabilization was frequently merely a statement of intention, for the institution had neither the financial resources nor the storage capacity to influence price levels significantly. Although this situation has changed somewhat in recent years, the storage capacity of INA has constantly been below minimum requirements. In 1955, an FAO expert prepared an estimate of the storage requirements of the country (89). For the five crops influenced by INA, he estimated the country's storage requirements at 466,700 tons on the basis of the level of production in 1955. INA would require storage facilities for approximately 200,000 tons. However, by 1963 even the theoretical capacity (which exceeds the actual) was still as low as 119,589 tons.⁶ Shortage of

⁶ Letter of May 5, 1964 from Dr. Moraizan, director of economic studies at the INA headquarters in Bogotá.

de Caldas; unpublished listings of Departamento Administrativo Nacional de Estadística for other departamentos; and Universidad del Valle, Facultad de Ciencias Económicas, *Censo Agropecuario del Valle del Cauca—1959* (Cali, 1963).

Acreage outside the census area distributed according to author's estimates based on statistics of the Rice Growers Federation and other evidence.

The division between irrigated rice and unirrigated rice is the author's, based on regional data of the Rice Growers Federation and other evidence.

TABLE 2.—PROFITS OF INA, 1960, 1961, AND 1962*
(Million current pesos)

Category	1960	1961	1962
Profits on imports	26.4	8.1	2.4
Profits on national production	3.4	2.8	—
Losses on national production	—	—	6.4
Total profits or losses	29.8	10.9	-4.0

* Data from Instituto Nacional de Abastecimientos (INA), *Informe presentado por el Gerente del INA al Sr. Ministro Agricultura* (Bogotá, 1963), pp. 21-22.

storage space led to serious difficulties with potatoes in 1959⁷ and with rice in 1962, when storage space was completely filled.

To cover operating costs and necessary investment in storage capacity, INA depends on its share of profits made on imports of foodstuffs at world prices. Domestic sale of wheat and other commodities obtained from the United States at effective net prices considerably below world levels are particularly profitable. Imports of American wheat indeed accounted for most of the profits in recent years, a strategic item for the Institute. The profits are divided equally between the Caja de Crédito Agrario and INA. The Caja Agraria increases its capital automatically, whereas INA uses part of these funds to build new storage facilities. In time of shortage it is rewarding to import foodstuffs and sell them at once; it is less so to store national commodities after bumper crops and wait months for an opportunity to sell (Table 2). INA has frequently been accused of preferring to import rather than to use its resources for stabilization of commodity prices. Such criticism has been justified to a certain extent by statements of one of the last directors of INA (85). It is also warranted by the figures in Table 2 as well as by comparison of the actual volume of wheat imported and the volume of rice bought on the national market.⁸ INA seldom bought substantial quantities of domestic rice—more than 10,000 tons only in 1946-49, 1958, 1959, and 1962, when the quantity of 60,300 tons purchased exceeded 10 per cent of the production (Table 3). A major intervention by INA occurred when approximately 35,000 tons of imported white rice ordered in 1961 at a time of scarcity arrived late and concurrently with a new and abundant harvest.

However, the first price-support measures taken by INA in 1948 had an important side effect in that they contributed significantly to improvement of rice quality. Toward the end of 1948, reflecting lack of experience of INA officials and absence of any kind of classification, INA silos were filled with very low-quality rough rice. In June 1949 INA refused to buy paddy which did not meet

⁷ Between 1946 and 1960 INA bought 30,009 tons of potatoes on the national market as a price-support measure; 13,256 tons were from the 1959 harvest. Of these a considerable proportion spoiled (41, pp. 46-47).

⁸ For example, the quantity of wheat imported in 1962 by INA, 133,411 tons, was larger than the total quantity of rice bought by the Institute on the national market since its creation, 132,234 tons, mostly paddy. The price support and stabilization policy affected less than 3 per cent of total production of the years 1945-62; the imports, designed to limit price increases, account for less than 1.5 per cent of production. Intervention has been sporadic, with some effect mainly within specific regions.

TABLE 3.—INA PURCHASES OF RICE, DOMESTIC AND IMPORTED,
COMPARED WITH DOMESTIC PRODUCTION, 1946-62*
(Thousand metric tons, rough basis)

Year	Domestic production	INA purchases ^a			INA purchases as per cent of domestic production
		Domestic	Imported	Total	
1946-49 total	643	17.4	—	17.4	... ^b
1950	241	—	5.8	5.8	2.4
1951	297	—	—	—	—
1952	328	—	—	—	—
1953	272	1.5	3.8	5.3	1.9
1954	295	2.3	16.2	18.5	6.3
1955	320	2.8	1.4	4.2	1.3
1956	342	3.7	.7	4.4	1.3
1957	350	7.3	15.4	22.7	6.5
1958	380	15.6	.5	16.1	4.2
1959	422	12.4	—	12.4	2.9
1960	450	2.7	—	2.7	.6
1961	474	8.5	52.8	61.3	12.9
1962	585	60.3	—	60.3	10.3

* Basic data for 1946-60 from Instituto Nacional de Abastecimientos (INA), *Informe presentado por el Gerente del INA al Sr. Ministro de Agricultura, 1961* (Bogotá), pp. 37-38; for 1961 from *ibid.*, 1962, pp. 3-6; and for 1962 from *ibid.*, 1963, p. 22. Our conversions to rough basis, and calculations of per cents, are from unrounded data.

^a Domestic purchases are probably largely rough rice, but purchases of milled rice, specified for 1961 and 1962 at 1.3 and 2.9 thousand tons respectively, have been converted to rough at 65 per cent. All rice imports were milled, and have also been converted to 65 per cent.

^b Since the bulk of INA purchases seem to have been made in 1948 the calculated per cent (2.7) is not representative.

minimum quality requirements. Bags of paddy had contained mixed types of short and long, broad and thin varieties, not clean and dry (31, p. 261). Some rough scales of grading were established with the help of the millers. General acceptance of official rice grades gave economic incentive to use improved varieties, a development partially due to the action taken by INA.

Enforcement of price support in 1948 filled INA silos within a year, and thereby eased the price pressure on producers. But soon the Institute had no further storage capacity to enable it to stay in the market. By June 30, 1963, however, storage capacity had so increased that 48 million pesos of a total inventory of 68 million consisted of rice (42, p. 28).

In other years the intervention of INA in the market has had favorable price results for some farmers in limited areas. The number of farmers who sold rice, the location of purchases, and the quantities involved are known only for the single year 1958. In that year only 1.1 per cent of the farmers sold to INA, only 5.2 per cent of the production was stored in its granaries, and in only three departments (Caldas, Cundinamarca, and Valle) did a substantial proportion of farmers sell their produce to the Institute. The total quantities bought in other regional markets were insufficient to have a noticeable effect on local price levels. Small growers were discouraged by favoritism among local managers, long delays in payments, and other matters (123, p. 33). The chief markets where purchases exceeding 500 tons were made were La Dorada in Caldas, Montería in

Córdoba, Girardot in Cundinamarca, Villavicencio in Meta, Cúcuta in North Santander, and Buga in Valle (34; 43, p. 2).

From its establishment until 1962, INA contributed only modestly to general improvement of rice prices; more often its effects were localized or restricted to specific groups of producers. The limited range of its influence was long a disappointment to the Colombian government, in sharp contrast with the apparent success of the Caja de Crédito Agrario.

The amount of credit available to the private sector of the Colombian economy depends less on deposits in banks than on their facilities for rediscount at the Central Bank. Margins of rediscount are wide and assure the banks substantial profits. To restrain inflation of credit, a rationing system had to be installed, both for the National Note Issuing Bank (Banco de la República) and the Agrarian Bank (Caja de Crédito Agrario). Thus, over the years, the changing amounts of credit extended for specific crops and areas are one of the best indicators of the current priorities of the Colombian government to foster specific sectors or enterprises or regions.

Private commercial banks can rediscount only an amount proportional to their capital plus special allowances for specific purposes. Part of the credit volume must be granted to crop and cattle farming, and at relatively low interest rates in order to promote agriculture. Decree 198 of August 30, 1957 forced commercial banks to lend 14 per cent of their deposits to farmers for livestock and crops. Law 26 in 1959 increased this to 15 per cent and provided for special discount facilities.

At times certain private banks have also been granted special quotas for specific purposes. Thus, in 1961, the Central Bank granted a special quota of 16 million pesos with a 3 per cent rediscount margin to the banks for credits to growers of rice, cotton, and sesame in Tolima and Valle (28, p. 12) who cultivated 50 to 60 hectares or more of one of these crops. Similarly the amount of credit granted by the Agricultural Credit Bank depends on rediscount quotas proportional to its capital. Credit availability of the Agricultural Bank can therefore be improved either by an increase in capital or by a change in the laws regulating the credit policy. Both methods have been employed at different times.

The capital of the Caja de Crédito Agrario has been increased steadily—for example, by appropriation of half of the profit made on imports from the United States under Public Law 480 and by transfer to the bank of property of the Coello-Saldaña irrigation scheme. This transfer did not improve bank liquidity, but it further expanded the Bank's rediscount quota at the Central Bank. Some of the changes in the legal ratio between the rediscount quota and capital of the Caja de Crédito Agrario are indicated in the following tabulation (5, p. 105):

250 per cent of capital from December 11, 1957
350 per cent of capital from December 19, 1958
440 per cent of capital from August 3, 1960

As with the private commercial banks, special quotas were over and over again added to the above amounts. Thus, in 1956, 10 million pesos were provided to assist the producers of non-centrifugal raw sugar (*panela*) (37, p. 100).

The Colombian government has clearly shown increased interest in agricul-

TABLE 4.—CHANGES IN CREDITS FOR AGRICULTURE, 1947–63*

Year	Total (million pesos)	By Caja Agraria	
		(million pesos)	(per cent of total)
1947	81	43	52.6
1949	90	68	75.7
1950	119	73	61.5
1951	164	92	56.0
1952	206	124	60.1
1953	212	...	...
1954	294	199	67.8
1955	355	195	54.9
1956	352	218	61.7
1957	419	200	47.6
1958	413	274	65.0
1959	614	325	53.0
1960	689	400	58.0
1961	764	453	59.3
1962	869	542	62.4
1963	989	574	58.0

* Data from Colombia, Departamento Administrativo Nacional de Estadística, *Anuarios generales de estadística*, issues for 1947–63; and Caja de Crédito Agrario, Industrial y Minero, *Informes de Gerencia*, issues for 1947–63 (Bogotá).

tural development: in 1949, 9.4 per cent of the total credits allocated to the economy was assigned to agriculture, but 15.2 per cent in 1961. In 1962, crop and livestock farmers who produced only about 30 per cent of the gross national product received more than a third of the credits (46, p. XXVIII).

This pattern is explained by the favorable terms of credit offered to farmers. Under Law 26 of 1959, the rates of interest on credit to crop and cattle farmers by commercial banks or by the Caja de Crédito Agrario are 2 or 3 per cent lower than the lowest bank rates and therefore extremely attractive to borrowers. About 40 per cent of the credits for agriculture go for purposes other than crop or livestock farming.⁹ This diversion of credits¹⁰ contrary to the aims of the legislation, however, is in no way new (20).

Because of the attractive low interest rates available since 1931, credits offered by the Caja de Crédito Agrario are in strong demand despite the red tape which is involved. Created initially to bring some relief to the victims of the great depression of the early thirties, the Caja de Crédito Agrario gradually developed into a central agency through which more and more agricultural credit was channeled. In 1949 it provided as much as three-quarters of the credits flowing into crop farming. The average for the last decade was about 60 per cent (Table 4). The credits offered by the Caja de Crédito Agrario go to small- or more particu-

⁹ Interview with Dr. Vega Franco, Director of the Department of Economic Studies of the Caja de Crédito Agrario, on April 6, 1964.

¹⁰ The private banks have many good customers engaged in agriculture, as well as in industry or trade, and granting inexpensive credits under the terms of Law 26 has often operated as somewhat of a bonus for them. The banks see no reason for going to great lengths to investigate the final use of these credits.

larly medium-size farmers whose capital assets do not exceed a certain maximum capital.¹¹

Notwithstanding the enforcement of rigid conditions for meeting credit requirements, the number of applicants able to satisfy the requirements were too many for the limited amount of credit available through the Bank. Since mid-1957 quotas have been imposed by areas and products, thereby permitting the Colombian government directly to influence the pattern of production through change of specific quotas. Under the regulations of this quota system credit applications amounting to 262 million pesos or one-fourth of the personal requirements of applicants were denied in 1962 (38, p. 21).

The Caja de Crédito Agrario has increasingly engaged in other activities of benefit to agriculture, such as the development of irrigation schemes, imports and production of fertilizers and implements, and distribution of selected seed. In the allocation of credits, preference was given to applications connected with the institution's services. On various occasions special terms were granted to buyers of agricultural machinery, seeds, or fertilizers distributed by the Bank.¹² Consequently, for many products the increase in the use of selected seeds or fertilizers is closely related to the total amount of credit available.¹³ This is especially true for potatoes, wheat, barley, and rice, all of which require high inputs of fungicides and fertilizers. Although reliable statistics are difficult to locate, it seems probable that increase has occurred in the percentages of total value of production of major commodities financed by credit.

The rice industry benefits unevenly from the Bank's credits. Farms in Valle that grew 160 tons of rice in 1959 are too large to be eligible. On the other hand, many settlers in the forests cannot get loans, having no guarantee to offer and being far from the Bank offices. But for those growers who have access to the "lines of credit" of the Bank, conditions have significantly improved since 1959. Before 1958 the percentage of credit allocated by the Bank to rice growers never reached 3 per cent of the total (Chart 3). In 1959, the Federation of Rice Growers accepted an increase in rice prices that was less than the general increase in prices. Simultaneously, it took steps to reduce production costs by promoting the general use of modern methods of cultivation. One of the arguments was that the implements, seeds, fertilizers, and weedkillers were available and that it was only necessary to have an adequate credit policy to make it possible for farmers to use them. During the next few years the credit extended to rice farmers by the Bank was sharply increased both in pesos and as a percentage of the total credit granted by the Bank. In 1961, modern techniques were, in fact, generally

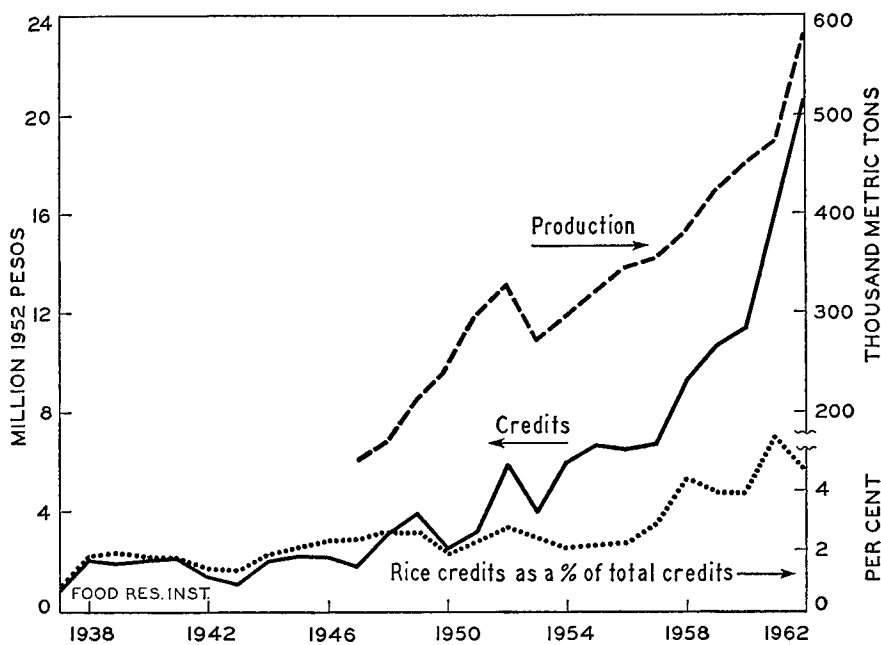
¹¹ Small farmers are often not able to qualify for loans because they lack the required guarantees. In Nariño, for instance, only 3.3 per cent of the population fulfill the conditions required for access to credit (126, p. 48). The maximum assets allowable have varied; in 1963 farmers with assets not exceeding 1.5 million pesos were eligible. Examples of maximum amounts of credit were as follows (129):

Short-term—less than one year	60,000 pesos
Medium-term—one to six years	100,000 pesos
For agricultural machinery	180,000 pesos
For irrigation, drainage, and wells	300,000 pesos

¹² For instance, in 1962, 540 tons of improved wheat seed were distributed in Nariño, 300 tons of which, valued at 1.8 million pesos, were on credit (38, p. 83).

¹³ The Agrarian Bank has for years been the most important seller of fertilizers, from one-half to as much as three-quarters of the total amount in some years.

CHART 3.—CREDITS FOR RICE AT 1952 PRICES AND AS A PERCENTAGE OF THE TOTAL CREDITS GRANTED BY THE CAJA DE CRÉDITO AGRARIO, AND ROUGH RICE PRODUCTION, 1937-63*



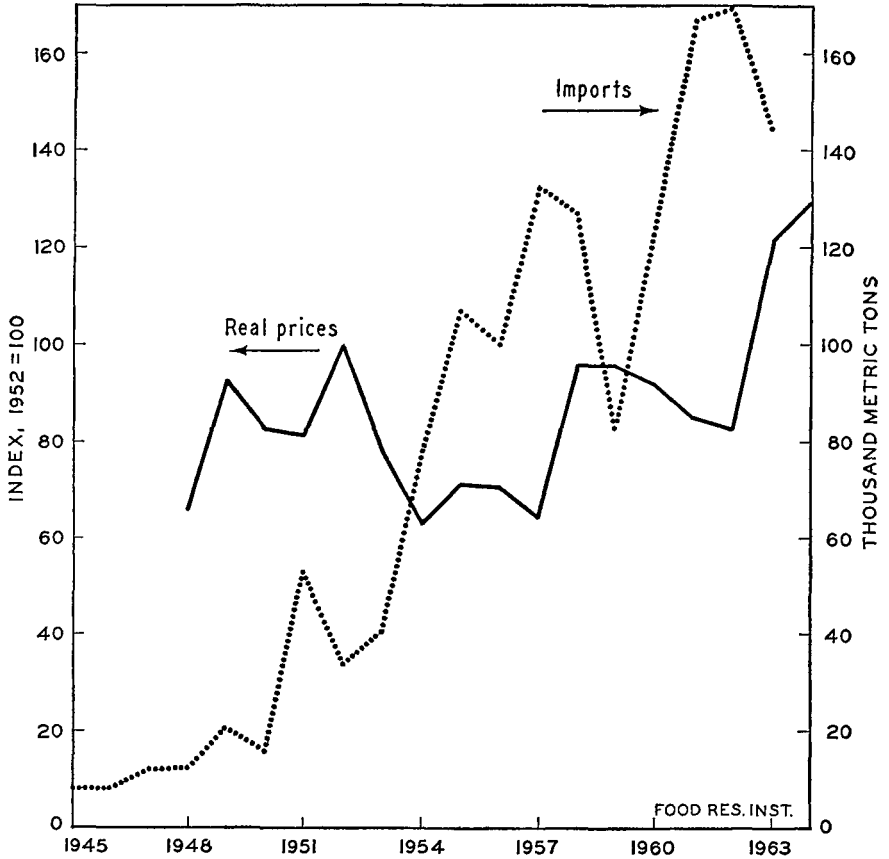
* Data for credits from Colombia, Caja de Crédito Agrario, Industrial y Minero, *Informe anual*, various issues, deflated by the price index 1952 = 100 described for Chart 2; production data as on Chart 2.

utilized in Tolima and Huila. Within two years paddy production increased from an estimated 80,000 to 140,000 tons in Tolima. Yields in areas receiving credits rose from 2,500 to 3,750 kilograms per hectare. At the same time and in the same area—and probably for the first time in the history of Colombian rice growing—a price-support policy was carried out effectively.

Rice farming, like other sectors of commercial farming, has been subject to a wide range of general-policy measures. In addition to those already mentioned, the import policies of successive governments were important. To a significant degree, the development of modern farming required imports of various kinds of inputs, such as fertilizers, pesticides, insecticides, selected seed, and machinery. Use of these inputs has been affected by their relative prices, judging at least from the increase in fertilizer consumption (Chart 4); usually the year-to-year changes are in opposite directions.

During the military government of Rojas Pinilla, the real price of fertilizers at the wholesale level was lowered by preferential exchange rates. This expanded the use of chemical fertilizers considerably; the Agrarian Bank sold 33,605 tons in 1951-52 but 101,945 tons in 1956-57 (35, p. 81). In 1958, the differential exchange rates were unified and the wholesale price of fertilizers correspondingly increased by 50 per cent. In 1963, a new increase in price of 50 per cent was due to protection of the recently established domestic nitrogen industry.

CHART 4.—FERTILIZER: IMPORTS AND INDEX OF REAL PRICES, 1945-63*



* Import data, for net weights, are from Colombia Departamento Administrativo Nacional de Estadística, *Anuario de comercio Exterior*, 1945-63 issues. Prices are the wholesale price index for manufactured fertilizers deflated by the general wholesale index, both series from *Revista del Banco de la República* (Bogotá), various issues.

Price increases naturally put brakes on the expansion of fertilizer consumption. Similar patterns have been noted for other kinds of imported inputs. Evidently the adverse effects on agriculture's terms of trade associated with such price changes associated with protectionism have represented a significant de facto "tax" on the agricultural sector, although restriction of rice imports worked in the opposite direction as far as rice producers were concerned.

Changes in policy initiated by different governments explain why many policy measures have not achieved their aims, and the aims of governments themselves fluctuate. The effect of protectionism on production has been somewhat offset by illegal importation of contraband, by official ordering of imports that too often arrived late and coincided with bumper crops, and by inflation of production costs due to the protectionism granted to producers of inputs. Measures to hold up prices have been successful only in specific places and only occasionally; and credit, while seemingly allocated with generosity tended somewhat to bypass agriculture. Research in rice has depended on changing interest in the

commodity and ever-changing preferences on the part of government. There were periods of interest, as in 1930 and 1938, and periods of indifference as in the immediate postwar period. Fortunately, the lack of official continuity has largely been compensated by action of the federation of producers, which was created initially for counteracting price control but which has been particularly active in introducing new techniques. This federation, aiming in the beginning at better prices and at defense of the financial interests of its members, successively organized the distribution of imported inputs, and of research and extension services. Now it has full responsibility in these fields and will henceforth be financed in part through a special levy on each kilo of rough rice milled, as required by legislation enacted in July 1964.

Since the creation of this federation in May 1947 by three farmers in Tolima, it has become the most important sponsor of constructive activity in the rice industry in Colombia.

EXERCISE OF SOME GOVERNMENTAL FUNCTIONS BY THE NATIONAL FEDERATION OF RICE GROWERS

The purpose of an organization of producers is generally to form a pressure group which can use its power to obtain higher prices for the commodity produced and lower prices for the inputs required. The Colombian Federation of Rice Growers conforms to the pattern in these aspects. However, it has also taken over some responsibilities, formerly of government, in such fields as research and extension service. It has been able to replace a rather erratic government policy with a fairly consistent course of action, thereby playing perhaps the most important role of any agency in modernization of the rice industry.

When in 1947 world prices of all grains were at scarcity levels, the Colombian government strongly desired to avoid substantial price increases. Through the Office of Price Control, it had fixed rice prices at a level alleged by some to be below cost; rice growers had to indicate the daily number of bags harvested, and in case of noncompliance faced confiscation of their harvest without further legal action. This was excessive, and on May 28, 1947, three important rice farmers met at Ibagué and founded the Federation of Rice Growers of Tolima. This young Federation, soon to become national, succeeded in its first year in abolishing all harassing regulations such as price controls, and in securing cancellation of import licenses (1, pp. 9, 11).

Since then the influence of the Federation on major policies concerning rice has grown constantly. Time and again it used its power to avoid imports for which there was no significant need; it exercised influence on the government to obtain better prices, to lower import duties on fertilizers and machinery, and to bring about the abolition of import duties on inputs, as with the 25 per cent duty on rice seed in 1952 (53, p. 40). In addition, the Federation repeatedly sought more favorable credit conditions. It also acted as a cooperative, storing spare parts of agricultural machinery and importing fertilizers.¹⁴ Its cooperative function throughout the years proved to be particularly favorable to enterprises in Tolima near a large number of Federation agencies.

¹⁴In 1953, for example, 500 tons of fertilizers especially prepared for rice growing were imported from France, 280 tons of which were used by the Tolima growers, who obtained considerable increases in yields (65, p. 15). This led to new imports of 2,000 tons (65, p. 18).

Although founded by private individuals in Tolima, the Federation became a semiofficial national institution in 1950. Until then its staff of five persons, including porter and typist, was too limited to deal with technical problems. An agreement on technical assistance was signed with the government, by which the Federation would include the whole country in its area of influence, would initiate information campaigns, research, and extension service, and advise the government on questions related to rice growing. As recompense for these services it would receive governmental financial support. The first Board of Directors comprised the director of the Federation of Coffee Growers, the Minister of Agriculture and his director of Crop Promotion (*director de fomento de cultivos*), and four rice growers.

The Federation operated on government subsidies for ten years. As early as 1951, it sought a compulsory contribution to its expenses from all rice growers (51); but in contrast to the powerful Federation of Cotton Growers, which had governmental approval for collecting such fees, the Federation of Rice Growers failed to gain approval until mid-1964. Voluntary contributions by its members, fixed at 5 centavos per kilogram of rice marketed in 1951 (64, p. 41), never attained any importance.

In 1960, under a new agreement with the government, the Federation retained full autonomy and was granted funds for specific purposes related to the development of the rice industry.¹⁵ This agreement indicated the growing power of the Federation. It contained no regulations on the composition of the Board of Directors, and it stated that 80 per cent of the total expenses would be borne by the government and the remaining 20 per cent by Federation members. In order to cover their portion the rice growers, at their National Congress in September 1960, decided to aid the Federation financially by paying a half centavo on every kilo of paddy rice produced. The payment would be collected through the rice mills or INA, effective December 31, 1960. The agreement was endorsed by the Federation of Rice Millers. In 1961 and the first months of 1962, the amount reckoned to be collected in this way was to be 2.37 million pesos. Actually, however, only 419,000 pesos were obtained (14, p. 10), and once more the Federation was in need of money.

But success in rice growing, accompanied by poor production of upland crops during the dry first half of 1964, so impressed the government that it was only too happy to ease its balance-of-payments problem by substituting rice for other foodstuffs critically undersupplied at rocketing prices. The *cuota de fomento*¹⁶ was made compulsory by national governmental decree (60), and thus the Federation's success in the development of the rice industry was rewarded. The financial resources of the Federation from these fees rose from an estimated goal of 120,000 pesos (generally unpaid) on 1951 production to an expected 6 million pesos (under compulsory levy) on 1964-65 production. Even allowing for the

¹⁵ Government funds provided under the terms of the agreement were to be used for (a) multiplication, guarantee, and distribution of improved seed; (b) technical assistance to farmers; (c) experimentation with new varieties on a regional basis; (d) cooperation with the government and local official agencies in the preparation of statistical data; and (e) advising the government in matters related to rice (63, p. 18).

¹⁶ The *cuota de fomento* is a fee paid by the miller or the National Institute of Supply for each kilo of rough rice milled, to the Rice Institute in support of research, extension, and other technical services.

trebling of the general price level in the meantime, the increasing financial resources and influence of the Federation are clearly evident.

The resources provided by government subsidies were first used for a general survey of the major problems of the industry, then for the creation of a technical department, the size of which increased year after year. The first two agronomists were appointed in 1953; six were at work in 1960 and sixteen in 1964. The first comprehensive survey of the rice industry was carried out in 1951 by a Brazilian expert who reported in detail its defects and its excellent potential (25). By the end of 1953, the technical department of the Federation in cooperation with the Banco de la República completed a statistical survey of the rice milled in every mill of Colombia—its origin, the quantities of seed distributed, and the capacity of mills (66). On the basis of this information it was decided that priority should be given to better seed selection, to the elimination of red rice, to diffusion of more modern methods of irrigation, and to experimentation with fertilizers. These projects were fraught with problems. For example, when plans had been made for organizing a rice census among producers, an official suggested utilizing the cooperation of an FAO expert who was at that time designing a sample survey for Valle. This expert, who was not responsible to the Colombian government but to FAO directly, was called in, and the Federation had to prepare a less ambitious survey after having wasted valuable time (83, p. 9). Although imports of superior seed were urgently needed, the idea prevailed in government circles that it would be better to select the seeds from scratch in the country itself. Imports of seed were not only delayed but were too small to meet requirements. The seed had to be multiplied by an operation similar to the one organized by the Rotating Fund of the Agricultural Bank, whose director offered his assistance; but when the moment came to finance the project his newly appointed successor had no time to consider such action. Since the sowing of rice could not wait, the Federation was hastily forced to cancel its contracts (83, p. 11).

The great merit of the Federation consists in the continuity it has been able to establish. Thus in 1957, after the devaluation of the peso, prices of imported seed rose so far that the Federation thought it necessary to design a plan for multiplication, classification, and selection of seed within the country. In 1958, seed multiplication farms and sorting plants as well as an experiment station (Nataima), were established and have continued to function smoothly and with good results.

The Federation integrated and unified extension services locally and regionally as far as possible. In Valle it provided funds for an agronomist, while that department paid two extension agents and provided their materials. In Tolima the departmental government appointed an agronomist to work for the Federation. In Huila the agronomist of the Federation was named director of the Secretariat of Agriculture of the department (131, pp. 14-15).

Not all projects undertaken by the Federation were successful. A promising plan to grow wheat in rotation with rice, a technique developed in Palmira, had to be dropped because the specialist in charge left for a better paying job. Yet overall results were very satisfactory. The introduction of a practical method to eliminate red rice in 1955 did away with one of the curses of rice cultivation; the use of selective herbicides cleared the fields of water-bred weeds which until

1959 had hampered production considerably. Herbicides also reduced the costs of production of upland rice, which became very profitable under mechanization. The success of the Federation's policy is particularly evident in seed multiplication.

More recently the Federation took over further responsibilities from government. After December 1962, when INA could no longer support rice prices, the Federation has stored surplus rice produced in Huila and Tolima. But this additional function depleted its finances, and in consequence, the government yielded to demands and authorized both the Federation and INA to trade rice for imported cars. The considerable profits to be made on importation of cars, which was otherwise prohibited, were to cover the difference between Colombian and export prices of rice, which are about one-third of the Colombian price. But following a prolonged drought in upland areas and a major crisis in food production, new domestic outlets for rice were opened and the export of rice for autos never materialized.

The operations of the Federation are concentrated mainly in Tolima. Of the 419,000 pesos contributed by members in 1961 and the first months of 1962, 210,000 pesos came from Tolima (14, p. 10). Four of the ten storehouses for fertilizers and seed are located in Tolima. An experiment station and a neighboring seed selection plant located in the heart of the rice belt between Espinal and Ibagué are easily accessible, and they offer better service to the 2,000 rice growers of the Tolima and Girardot areas than to the 50,000 spread over the country.

Credit facilities obtained in 1961 to promote development of the rice industry have been applied largely to the Espinal area, the site of the Coello-Saldaña irrigation project in the heart of Tolima. Clearly, the Federation of rice growers represents mainly large farmers growing rice under irrigation, principally in the department of Tolima. The concentration of government favors, such as special credits, relief to a private organization independently engaged in a price policy of its own, and indirect subsidies, theoretically for all the growers but in practice mainly for growers in this belt, is questionable on the grounds both of equity and of maintaining regional equilibrium. Nevertheless, this lack of balance is of minor importance compared to the positive impact of the Federation's activities since its inception.

IMPROVEMENT IN THE QUALITY OF SEED

Within 20 years the rice industry has undergone considerable technological change, with improvement in the quality of seed the most important single factor. The Federation has been largely responsible.

Until World War II the seed used throughout most of the rice belt was not selected, particularly in the north of the country. As late as the 1950's settlers were still clearing land by burning the forest or brush, and they cared little about pure seed. In the Río Lebrija area in Santander (133, pp. 8, 9) and in Córdoba also (114, p. 9), as many as six varieties could be identified on one plot (103, p. 5).

Small farmers do not seem to worry much about the need for selected seed. They grow rice primarily for subsistence, and only the surplus is sold. In the swampy and forested areas of southern Córdoba and Bolívar, for example, the surplus is sold to petty traders, and the price is a small fraction of that paid by the mill. No premium is paid for quality.

TABLE 5.—ESTIMATES OF IRRIGATED AND UNIRRIGATED LAND UNDER RICE, 1948*
(Thousand hectares)

Department	Irrigated	Unirri- gated	Total	Department	Irrigated	Unirri- gated	Total
Antioquia	—	6.7	6.7	Magdalena	1.8	2.2	4.0
Bolívar	—	23.9	23.9	Meta	—	10.4	10.4
Boyacá	—	10.6	10.6	Nariño	—	.7 ^b	.7 ^b
Caldas	—	7.0	7.0	Norte de Santander	1.4	.6	2.0
Cauca ^a	3.3	—	3.3	Santander	—	2.1	2.1
Córdoba	—	39.6	39.6	Tolima	10.0	1.4	11.4
Cundinamarca	1.3	.4	1.7	Valle	16.0	—	16.0
Chocó	—	5.0	5.0	Caquetá	—	.3	.3
Huila	5.0	.3	5.3	Total	38.8	111.2	150.1

* Data based on unpublished records on rice production of the Ministerio de Agricultura de Colombia, División de Economía Rural, compiled by Raúl Varela Martínez (Bogotá, 1949). In cases where Varela Martínez only gave totals, the separate estimates for paddy and upland and swamp rice were made by the author on the basis of other available data and personal knowledge.

^a For Northern Cauca only.

^b For River Patia region only.

Naturally, the mills face problems in processing mixtures of ripe and unripe grain or varieties of different kernel length and seed coat. They are willing to pay premiums for superior qualities, and for export markets general uniformity of grain quality is regarded as desirable or even essential. Around 1945, one of the larger mills tried to improve the quality by distributing its own uniform, classified seed, either on credit or in exchange for lower qualities (7, p. 2). Before 1950, purebred upland rice was grown only in a small area of northern Colombia.¹⁷ With the growing importance of trade, notably after the increase in production and the establishment of INA, that agency played an important role in stimulating demand for uniform seed. The wide variety of types and qualities of rice not only presented serious obstacles to INA in its efforts to regulate price, but also hampered exports of surpluses. When INA began to buy, it was literally flooded with rice of the lowest quality, and therefore soon established certain standards of quality which farmers had to meet if they wanted to sell to it (4, p. 261). Producers, especially in the northern part of the country, complained about the arbitrary character of these standards (68).

Soon after the abolition of import quotas in 1948, a surplus emerged of rice available for export. Rice of the north coast was sent to Venezuela, but it was of such poor quality that a Venezuelan laboratory declared it unfit for human consumption. This incident served to dramatize a situation both alarming and embarrassing to rice growers, INA having intervened in the market by buying rice and establishing quality criteria.

Irrigated areas expanded and accounted for about one-fourth of the acreage and one-third of the production in 1948 (Table 5). Valle and Tolima were then the two main producers of irrigated rice, but uninterrupted cultivation of rice

¹⁷ This was the Caracolicito colony, an isolated area of 50,000 hectares located southwest of the Sierra Nevada de Santa Marta. Under the supervision of an agronomist the settlers grew 1,000 hectares of rice per year by the method of shifting cultivation. Careful selection of seed alone accounted for the quality: the rice "Colonia" was the only purebred upland rice grown in Colombia before 1950 (136, p. 9).

without rotation had greatly stimulated the development of weeds and red rice, the most serious threat to rice cultivation between 1945 and 1955. The use of pure seed was the best method of fighting red rice at the time. Red rice is a type of short-grain rice (below 5 mm.) used in Asia for specific purposes, such as for certain pastries. This variety has a red seed coat, very strong and adhesive. When the rice to be milled contains red rice, care must be taken that the red seed coats are removed and if so the rough rice must be overmilled. Long-grain rice varieties of 6 mm. or more are more delicate and break easily if mixed with the red rice; the more broken the rice from milling, the lower the quality and the price (26, pp. 13, 14). If quality is of no importance, red rice offers the considerable advantage of being immune to most plant diseases, in particular the *hoja blanca*, the virus disease, which destroyed large areas of rice plantations around 1958. It has the added advantages of giving relatively high yields, and a short growing season of 110 to 115 days. Before a method was developed for applying selective herbicides, it was almost impossible to eradicate red rice; it multiplies rapidly and easily, and shatters easily also, so that many of the grains fall to the ground before harvest and sprout the next year.

The gap between prices of average quality paddy and paddy containing red rice has widened from year to year. In 1954 in Valle a *fanega* (600 kg.) of paddy sold at 160 pesos when it contained much red rice, at 220 pesos when it was of standard quality, and at 280 to 300 pesos when relatively clean and of the Bluebonnet or Rexoro variety (137, p. 35). In 1955 production costs for a field producing 2.5 tons of paddy under irrigation were estimated at 780 current pesos per hectare. At that time paddy rice was bought at 33 pesos per bag of clean rice, and at 14 to 17 pesos when containing red rice, depending on the percentage. Thus the gross value of the produce fluctuated between 560 and 1,320 pesos. With the given yield some farms would make a profit of 540 pesos, whereas others would lose as much as 220 pesos (108).

Red rice gradually spread to all but one of the irrigated areas. In 1948, half of the national irrigated rice area, 19,319 hectares, was located in the Cauca Valley (Table 5). This region, the first in Colombia to introduce irrigation, used the soca system. Without reseeding one crop followed the other and many rice growers did not know when the rice had been seeded. This labor-saving method was largely responsible for the low quality of the local product and for the spread of red rice.

Until 1930 red rice was unknown. Only four varieties, none of them pure, were grown in Valle; these were Guayaquil, Guacarí, Bomba, and Japonés. In 1930, the experiment station at Palmira introduced the purebred "Fortuna" variety, which was soon to be adopted in Tolima and Valle. In the new enthusiasm for rice which followed abolition of the Emergency Law, a rice grower in Palmira, Rafael Madrinas, imported from Ecuador in 1930-32 (134, p. 4) a new rice variety, called *arroz colorado* there, which was said to give very high yields. In Colombia it was called Guayaquil and was mixed with the older Guayaquil; it was soon preferred to Fortuna. The first crop was inferior to Fortuna, but with each soca, yields improved and it soon overtook Fortuna. This was one of the origins of the red rice that spread so rapidly in Valle. Not only the proportion of the red rice but also losses in milling and content of extraneous matter were

extraordinarily high; in 1948 in Valle, only 21,000 tons of milled rice were produced from 45,000 tons of humid paddy (77).

Tolima, then the second most important irrigated area, soon faced the same difficulties as Valle despite the relatively later introduction of rice growing. Before World War II when rice growing expanded rapidly, Tolima farmers used all varieties, long-grain and short-grain rice of a long growing period and of a short. The important thing was simply to obtain seed, any seed. Lacking appropriate assistance, farmers were forced to make all kinds of experiments. Due to ignorance, red rice finally spread in this area as well; in 1939, a farmer in the vicinity of Armero bought seed of the *Majagual* variety in Puerto Giraldo, Atlántico, and sowed half a hectare, and that seed had red rice mixed with it. The experiment station at Armero persuaded the farmer to destroy his crop, but unfortunately a mill in Armero had brought considerable quantities of the same rice from the north and sold them as seed. Agronomists at the experiment station learned about it too late. Moreover, farmers in Venadillo soon noticed its strong resistance to pests and its high yields. Before long it had become the most popular seed. Deterioration in quality resulted in a drop in price, and a year later the total acreage planted in rice had fallen by half (56, p. 19).

Once new irrigation systems had been established, the problem of mixed varieties and spreading of red rice cropped up almost everywhere: in the banana belt as well as in the central part of the Magdalena Valley, in Huila, Tolima, and Cundinamarca. The only exception was Norte de Santander.

In 1947-48, after a crisis in the banana industry, about 3,000 hectares of land in the banana belt already irrigated were planted in rice. Improper care, however, diminished soil fertility rapidly, and weeds as well as red rice spread widely. Yields decreased and within five years only 800 hectares of irrigated land were sown (27).

Methods of irrigation that had been developed around Cúcuta (northern Santander) since 1942 helped to establish an area of production isolated by high mountains or long distances from all other rice-growing regions. In this area, careful supervision of the crop from the beginning, and production of irrigated rice on a few large plantations, accounted for the maintenance of a purebred seed, free of red rice. In 1942 the government had appointed a young agronomist to assist in introducing rice into the Cúcuta area. Under his leadership, first as a government official, then as a manager, and finally as an owner of rice fields, appropriate types of seed were selected. After *Fortuna* turned out to be a failure, the *Canilla* variety, brought impure from Magdalena department, was tried after being cleaned of an approximate 10 per cent of other varieties. But it had such serious drawbacks, as a propensity to shatter, a long growing period, and a grain easily broken in milling. Locally these disadvantages were fully compensated by high yields—as much as 6,500 kg. of green paddy per hectare—and shattering during harvest by machine was not too great a hazard because around Cúcuta the topography makes the use of machinery impossible. The annual visit of migrating birds does not permit a second crop in the same year. Finally, rice is alternated with irrigated pasture, providing fodder for the milk cows supplying the city of Cúcuta.

As in Tolima, landowners made extensive use of the technical assistance

provided. Hence quality remained constant, soils were not depleted, and red rice did not appear. It remains open to question whether such discipline would have been possible on smaller-scale operations (113, pp. 10, 12). While the success of rice cultivation in northern Santander was initially due to governmental rice campaigns, a change in government unfortunately terminated efforts to promote the industry.

Technical assistance to Colombian rice growers has actually been rather limited. Government aid has been casual in both research and extension service. Two major experiment stations were located in the rice belt in Palmira (Valle) and Armero (Tolima) and continued to function for many years. As mentioned earlier, introduction of the Fortuna variety was one of the first accomplishments of the Palmira Experiment Station, established at the end of 1928. Then for a few years that Station made no substantial contribution, until President Santos (1938-42) decided to promote modernization of Colombian agriculture. About 100 new varieties were introduced at Palmira from all over the world in 1938-39, and the Palmira Eight variety, a Fortuna adapted to the climatic conditions of Colombia, was developed. Governmental interest in rice waned later (137, p. 256).

In the Armero region the rice boom began around 1935, earlier than in the rest of the country, but even ten years later the local experiment station had not had the opportunity to study the adaptation process of rice because of lack of irrigation at the station (23). A considerable general effort in the field of extension service was also made during the Santos administration. The most notable reorganization of technical assistance to farmers took the form of campaigns concentrating on strategic commodities, such as cacao, wheat, and rice. The rice program was conducted in the eight rice areas considered to be the most important.¹⁸

The main objective of the campaign was to achieve a bulk selection of seed. Rice loses its germination power very rapidly, and this leads to overplanting of the fields with waste of seed. In Valle, for instance, rice growers sought seed having a germination power of 80 per cent. If fewer than 80 grains of 100 on a humid cloth germinated, a corresponding amount was added to the seed (26, pp. 13-14). This, of course, led to considerable waste of seed and increased costs.

Sorting machines were set up in the main rice-growing areas in order to achieve more uniform paddy and better seed distribution in the fields. The sorting machine in Neiva, Huila was useful because it retained 71 kg. out of 100 of so-called "selected" seed, 67 kg. out of a lot considered of good quality for seeding, and 65 kg. from 100 of average quality (137, p. 36). Yet the campaign had only partial success, for rice growers often failed to bring their seed to be classified until the last moment and the field had already been prepared (137, p. 42). Also, mills paid no premium for quality. In Valle rice mills applied no price discount even though there was a weight loss of 1 kg. out of 125 in a single day (111, p. 17).

The scarcity of agronomists and their constant shifts in residence and appointments unfortunately limited effective change in cultivation techniques. A sample of eleven rice varieties for use in a program of selection was gathered at

¹⁸ a) Achí, Majagual and Pinillos in Bolívar; b) Ayapel, Tierra Santa, Monte Libano, and Cecilia in Córdoba; c) Montería, Rionuevo, Lobo, Doctrina, El Viento and Lorica also in Córdoba; d) Villavicencio and Acacia in Meta; e) Campoalegre and Palermo in Huila; f) Palmira, Ginebra, Florida in Valle and Puerto Tejada in Cauca; g) Armero and Venadillo in Tolima; h) El Espinal also in Tolima.

the farm "El Danubio" in Tolima; but the agronomist in charge was assigned to another job and the project came to nothing.

Other agronomists sought to introduce methods of bulk selection, but the market situation for rice was so good at the time that quality was of no importance. Farmers lost interest in the work as their rice, so they said, was spoiled for nothing (56, p. 18). As so often with government action, interest soon dissipated; yet over a longer period, the favorable results of seed selection became evident. Left alone to counteract decreasing yields, spreading of pests, increase of red rice, deterioration of seed, etc., some large farmers took the initiative and selected their own seed. One farmer in Aracatacá, worried about declining yields, visited American experiment stations in Stuttgart, Arkansas, and in Crowley, Louisiana, in order to study selected varieties there. He returned with 24 varieties of seed. After experimentation he continued to cultivate six of them, including Bluebonnet and Rexoro, both of which found a good market in Colombia and Venezuela (137, p. 61).

In Tolima, in the center of the country, most farmers contented themselves with checking seeds with the naked eye in order to stop the spread of red rice. The more progressive among them decided to import seed directly from the United States, hoping to check decline of yields as well. Farmers in El Espinal succeeded in obtaining a substantial increase in yields, harvesting 50 to 60 bags of first-quality rice per hectare without using fertilizers or any other means of crop improvement (56, p. 20). Professor Norman Efferson, on the occasion of his journey through Colombia in 1949, confirmed that they were on the right track (82).

The Federation of Rice Growers of Tolima, later the powerful National Federation, imported seed from Venezuela to meet the needs of members. The grading scale for paddy established by INA and the rice millers of Tolima at the suggestion of the Federation in 1951 (Table 6) indicates the low quality of seed commonly in use.

Improper care of the soil and backward methods of cultivation caused quality to continue to deteriorate over the years while costs of production increased. In 1950, the market was so good that established farmers were able to sell rice con-

TABLE 6.—CLASSIFICATION SYSTEM USED AND LEVEL OF SUPPORT PRICES FOR MILLED RICE IN TOLIMA, 1951*

Category	Minimum of whole grains	Per cent of total			Support price (pesos per carga) ^a
		Broken	Maximum Stained	Red	
Normal rice					
1st quality					
Type A	70	20	5	5	105
Type B	60	25	5	10	95
2nd quality	50	25	5	20	90
3rd quality	40	30	5	25	80

* Javier Pulgar Vidal, *El arroz en Colombia*, Federación Nacional de Arroceros (Bogotá, 1956, typed), p. 114.

^a One carga equals 125 kilograms.

taining as much as 90 per cent of the red types (6). In several localities entire paddies, invaded by weeds, had to be converted into pasture. One way of solving this problem was seed improvement. When in 1950 the National Federation of Rice Growers was provided by the government with an annual subsidy, it became obligated to organize technical assistance for the rice industry. The manager of the Federation first toured the whole rice-growing area of the nation in the company of a Brazilian specialist (64, p. 32). A conclusion reached on this tour was that there was urgent need for better seed. As a first step, imported seed should be reproduced; and the Federation moved toward the purchase of a government farm in Tolima for that purpose. Necessary authorization was obtained from the proper Minister, but before he could act, he was replaced and the new Minister specified certain conditions of sale but left before an agreement was reached. A third Minister had no interest in the project, so that the Federation decided itself to classify national seed varieties as a first step (83, p. 9).

In 1953, increased demand for rice of good quality was revealed by important differences in price. The Technical Department of the Federation made a detailed survey of the rice belt, once more to find that lack of selected seed and increasing invasion of red rice were the two basic factors crippling the industry. To solve the problem, the Federation, in 1954, imported 100 tons of Rexoro seed and 100 tons of Bluebonnet 50, a variety previously unknown in Colombia. This single measure caused yields to rise from 35 to 55 bags per hectare (8, p. 2). The Federation offered a premium of 10 per cent to those who would sell to it the produce of multiplication of these varieties, but success was limited because a premium of 46 per cent was being paid on the market for the same seed. In order to further promote use of superior seed the Federation, with the financial backing of the Agrarian Bank, in that same year signed contracts with farmers willing to engage in seed multiplication under its technical control. Unfortunately, the management of the Agrarian Bank changed just then; the new director was not interested and canceled the agreement; and in order to protect its financial standing the Federation was forced to withdraw from the contracts made with farmers (83, p. 10).

By 1955 word of the good results to be had from selected seed imported in 1954 had spread among rice growers. Imports of certified seed then increased to 700 tons, 500 tons of Bluebonnet 50 and 200 tons of Rexoro, which were distributed among 200 farmers in Tolima, Huila, Valle, and Meta (10, p. 3). This was almost enough to plant 4,000 hectares, or 20 hectares per farmer. In 1956, imports of selected seed increased to about 1,000 tons (10, p. 3). But devaluation of the peso in 1957 tremendously increased the price of seed and other inputs, the purchase of which had formerly been encouraged by a particularly favorable rate of exchange.¹⁹ The price of rice seed imported from the United States rose so sharply that it became almost essential to produce the seed in the country itself.

Despite the evident demand for superior seed the average rice grower as late as 1954 was still using badly cleaned and poorly dried seed, occasionally even

¹⁹ For instance, the general wholesale price index increased from 153.1 to 187.8 between 1957 and 1958, but the index for manufactured fertilizers rose much more, from 98.9 to 172.6 (base 1952 = 100) (120, pp. 644-45).

the produce of his own harvest, as appears from the following survey data reported for Valle in 1954 (86, p. 22):

Origin of seed	Number of farms
Local mills	264
Own farm	28
Palmira Experiment Station	2
Tolima	2
National Federation of Rice Growers	2
Total	298

A long-term program was drawn up by the Federation, providing among other things that seed produced domestically be selected and certified and that an experiment station be established to develop new varieties. In 1958 two seed sorters were set up, one in Ibagué and one in Villavicencio, while two others were being built in Cali and Neiva. In that year more than 90 per cent of the acreage of irrigated rice was planted in Bluebonnet 50 or Rexoro, and notwithstanding their susceptibility to diseases, yields increased considerably. Average yields obtained with the older varieties, Fortuna, Guayaquil, and Palmira, did not exceed 2,000 kg. per hectare, whereas with Bluebonnet 50 and Rexoro average yields were 3,300 kg. per hectare (107, p. 21). With the continued use of these new seeds a surplus in production was expected. But the virus disease *hoja blanca*, first discovered in Colombia as early as 1935 (81, p. 22), hit the Caribbean zone in the later 1950's. Red rice and traditional seed were scarcely affected but Bluebonnet 50 and Rexoro were highly susceptible. The disease destroyed the 1956 rice harvest in Cuba. It affected the rice industry in Venezuela in 1957 to the extent that an expected harvest of 250,000 tons proved to be merely 20,000 tons. It spread to Colombia in 1958, notably to the Cauca Valley and parts of Tolima, and struck heavily in the eastern Llanos. In 1959, the farmers of the Llanos who grew Bluebonnet and Rexoro lost their crops; only those who followed the advice of the Federation to change varieties to Canilla and Fortuna broke even. In fact, 80 per cent of the rice area in the Llanos was sown to Canilla in that year (70, pp. 18-19). Yields of 6,060 kg. of paddy per hectare under irrigation were obtained compared to 2,000 kg. per hectare of Bluebonnet 50 affected by *hoja blanca* (12, p. 13).

In 1961 a total of 187 tons of seed (mostly Bluebonnet 50) were imported from the United States, multiplied later by qualified farmers under Federation supervision to about 3,750 tons. Furthermore, 2,045 tons of irrigated rice grown under conditions making it suitable for seed use, but not from imported seed, were subjected to the process of classification (46, pp. 650-51).

An indication of improvement in quality and in incentive to rice growers is given in the rice classification table used by INA (Table 7). Formerly four categories existed, but now that six have been established, the margin of tolerance has been considerably reduced. Thus, first-quality rice could once contain up to 10 per cent red rice, but now only 1 per cent; and second-quality rice, which previously could contain up to 20 per cent, is now limited to only 4 per cent, etc. As a further measure in the expanding seed program, in order to cope with an expected production of 15,000 tons of grain from the multiplication of imported seed, the Federation undertook to construct storage facilities equipped with the

TABLE 7.—CLASSIFICATION TABLE FOR WHITE RICE, 1961*

Type or category number	Maximum number of objectionable seeds in 100 g.	Maximum percentage of					Common name	Requirements regarding color and appearance
		Damaged grains	Chalky grains	Red grains	Broken grains			
					Total	Small ^a		
1	1	1.0	1.0	1.0	5.0	.1	Excelso	vitreous white, cream, well polished
2	3	2.0	5.0	4.0	15.0	.5	1st	white, cream, slightly grey, slightly pink, well polished
3	7	3.0	7.0	8.0	25.0	1.0	2nd	grey, pinkish, slightly yellow, polished
4	12	4.0	10.0	12.0	35.0	1.5	3rd	grey, pinkish, yellow, polished
5	18	5.0	...	...	50.0	2.0	Popular	grey, pinkish, yellow polished

* Data from Jorge Arana Sánchez, *Margenes de comercialización y algunos aspectos del mercado de arroz, maíz, frijol, trigo, papa* (Instituto Nacional de Abastecimientos, Bogotá, June 1961), p. 25. A sixth category, Low Quality, is white rice that does not comply with the above requirements.

^a Broken rice that passes through a sieve of five and one-half sixty-fourths of an inch.

necessary classification machinery and dryers in Ibagué and Neiva in 1962 (14, p. 7). They have since been completed.

Varieties obtained from domestic multiplication of imported material seem to give lower yields, for they are at least mildly affected by the *hoja blanca*.²⁰ In order to overcome this, the Nataima Experiment Station developed a new variety, completely immune to the disease, which gives a 30 per cent higher yield than seed commonly used.

Supervised credit contributed significantly to increase in rice production after 1961. The idea of attaching conditions to credit offered by the Agrarian Bank, such as the use of certain varieties of selected seed, had been conceived as early as 1948 (102, p. 30). But it was not put into effect until 1961, when an agreement was reached between the Federation, the Agrarian Bank, and private banks. As a first step under the new program, supervised credit was granted to producers in Espinal, Guamo, and Purificación in Tolima, and Campoalegre, Palermo, and Neiva in Huila. Willingness to accept technical supervision by the Federation and to use selected seed were the basic requirements for loans (2, p. 7). There was a 35 per cent increase in yields in the selected areas (21, p. 6). As early as 1961 selected seed was used by about 60 per cent of the rice growers in Huila, 42 per cent in Tolima, and 40 per cent in Valle (45, p. 651). In 1964 a goal was set to produce as much as 50 per cent of the seed required for crops planned in Huila, Tolima, and Norte de Santander. As much as 5,000 tons of seed produced from first-generation imported Bluebonnet 50 and Rexoro were available for the first crop of 1964 (22, p. 46).

Differences in rate of progress of various areas, particularly in the use of seed, led to increased concentration of the rice industry around areas where modern methods of cultivation and modern equipment were available. These were actually the centers of greatest activity on the part of the Federation.

MARKETING AND MILLING

Pattern of Marketing and Distribution of Mills

Technological advance in the rice industry has been sustained by a continuous expansion of consumer markets. Indeed, the pattern of the rice trade is directly dependent on the food consumption habits of the large urban centers. In 1962, only five departments (Cundinamarca, Valle, Atlántico, Antioquia, and Nariño) required imports of rice from other parts of the country. All others had surpluses of white rice (44). The four major cities where the consumption is largest, Bogotá, Medellín, Cali, and Barranquilla, are located in the deficit areas.²¹ On the other hand, the townspeople on the north coast, in Barranquilla and Cartagena, traditionally consume cheap rice, brought up by boat, which has been grown on the banks of the Magdalena, Cauca, Necchi, San Jorge, Sinú, and

²⁰ For example, in Armero the sugar mill Pajonales planted approximately 500 hectares of very fertile land in rice for two consecutive years using modern techniques and methods, in particular the Japanese system of seed beds and transplanting. The first harvest, obtained from imported seed, averaged 4,200 kg. of paddy per hectare. But in the second harvest, when seeds multiplied on the spot were used, the yields averaged only 3,800 kg. per hectare—a fact deserving attention because Pajonales in one of the producers of seed sold by the Federation (71, pp. 30–31).

²¹ Rice consumption is not directly proportional to the population of these four cities. Medellín, the second largest city, does not rank second in rice consumption because the people of Antioquia eat beans and white maize bread rather than rice, as do people in the coffee belt.

Atrato rivers. Although there is some trade between the major belts,²² rice trade is concentrated around the center of Bogotá, Cali, and Barranquilla. Bogotá is the market center for rice produced in Meta and in the middle Magdalena. Irrigated rice grown in the Valledupar area of Atlántico competes with that of southern Bolívar and the borders of Córdoba and Antioquia. Cali consumes surpluses from Nariño, Cauca, part of Huila and Caqueta, as well as some of the produce of Tolima.

The marketing channels for rice vary greatly with growers' capital resources, and with location, and type of product. Four marketing systems prevail (57, p. 14): (1) traditional bartering by farmers in Chocó; (2) sale of the crop in the field before harvest; (3) among modern farmers rice sold as paddy, with financing through mills or otherwise; and (4) among large modern farmers, sales of white milled rice, the rice being milled on the farmers' account. In the northern part of the country, small farmers lacking capital resources are frequently in debt to salesmen from whom they have received during the year small amounts of money or, more often, such items as seed, food, or other articles for daily use. At harvest time they repay these loans with their produce, which, however, is bought by the salesmen at prices and under terms of payment far below normal standards. In some areas most of the produce is already committed before harvest. In Acandi on the north coast of Chocó at least 80 per cent of all the rice growers were so indebted in 1952 (101, p. 16). Exceedingly high rates of interest are charged under these circumstances, said to be as high as 300 to 400 per cent in Carmen de Bolívar in 1955 (11, p. 20). When a survey of the rice industry was made in that year, the director of the Federation noted that all over the department of Bolívar the Agrarian Bank was insufficiently active. The farmers were too far from the local agencies, and were also unable to overcome the maze of red tape then prevailing. Thus they became the prey of salesmen. In some parts of the department of Córdoba neither the rates of interest charged by petty traders nor the impact of the Agrarian Bank have significantly changed.

Small farmers settled on the alluvial shores of the rivers cultivate swamp rice, the *forastero* varieties, under natural irrigation. Seed beds are prepared at low water during the dry season; planting is done when the water starts to rise; and the crop is harvested when the waters recede. Generally these fields are small but reached easily by boat. At harvest time, the salesmen appear and gather all the small surpluses available, paying ridiculously low prices. The total quantities involved are rather significant. The salesmen play a vital role in providing a market, unsatisfactory as it may be because of their usurious terms. As was demonstrated in 1947, the government's price control office exercised its influence to lower the prices of milled rice; the millers then refused to grant credits to the salesmen, who in turn refused credit to the farmers. Production in Córdoba decreased considerably because of lack of seed and other inputs (69, p. 16). Even more rudimentary is the barter of rice for salt, tobacco, petroleum, cheese, and dried meat along the Atrato and San Juan rivers in Chocó (8, p. 13).

Modern rice cultivation under irrigation requires not only consumption credit for subsistence but production credit as well. Although modern farmers have better access to banking facilities than formerly, certain credit restrictions still

²² Huila, for instance, has found a good market for first quality rice in Medellín.

hamper their work. Hence, they promise their produce to salesmen or mills in exchange for immediate cash.

During the rice boom of 1948–51 fortunes were made by financing rice growing. Cultivators of less than 100 hectares frequently lacked financial means, and turned to lenders. In Tolima a farmer growing 100 hectares and counting on a harvest of 1,700 to 2,000 *cargas* of paddy obtained a loan of 40,000 pesos. He had to promise to sell the whole harvest through the lender, granting him a discount of 15 pesos per *carga* (125 kg.) from the prevailing price. In most cases the lender was also the buyer, but sometimes he directed the farmer to another dealer who was buying for cash, naturally with a certain discount, this being a fresh source of profit both for the dealer and the lender (56, pp. 29–30). Despite such blatant exploitation, the farmers managed to survive, a fact which reveals the opportunities for large profits then existing.

Mills are another and more favorable source of credit for farmers. The capacity of the mills always exceeded their own needs, so that fierce competition existed among them and in turn affected the financing of harvests.²³ At seeding time a fixed rate of interest is customarily established and the harvest must be sold to the mill at the price effective at seeding time. This system prevails in the major areas of irrigated rice, as in Magdalena (17, p. 24) and in Tolima (123). In the latter department in 1959, 10 out of 15 mills were buying rice directly from producers. In other areas the wholesale operations and the milling were carried out by different organizations, the wholesalers paying a commission to the millers for the milling. Three-fourths of the mills in Meta were working on this basis in 1961 (124).

Finally, many of the large farms themselves have rice mills. Farmers in some of the new areas were located so far from a mill that they had to build their own facilities, as in northern Santander (113, p. 27). The close connection between rice farms and mills made at once for great flexibility of price fluctuation and for the improvement of qualities. Many proprietors of rice mills own rice fields from which they supply part of their orders. Others are closely related to rice growers by family ties.

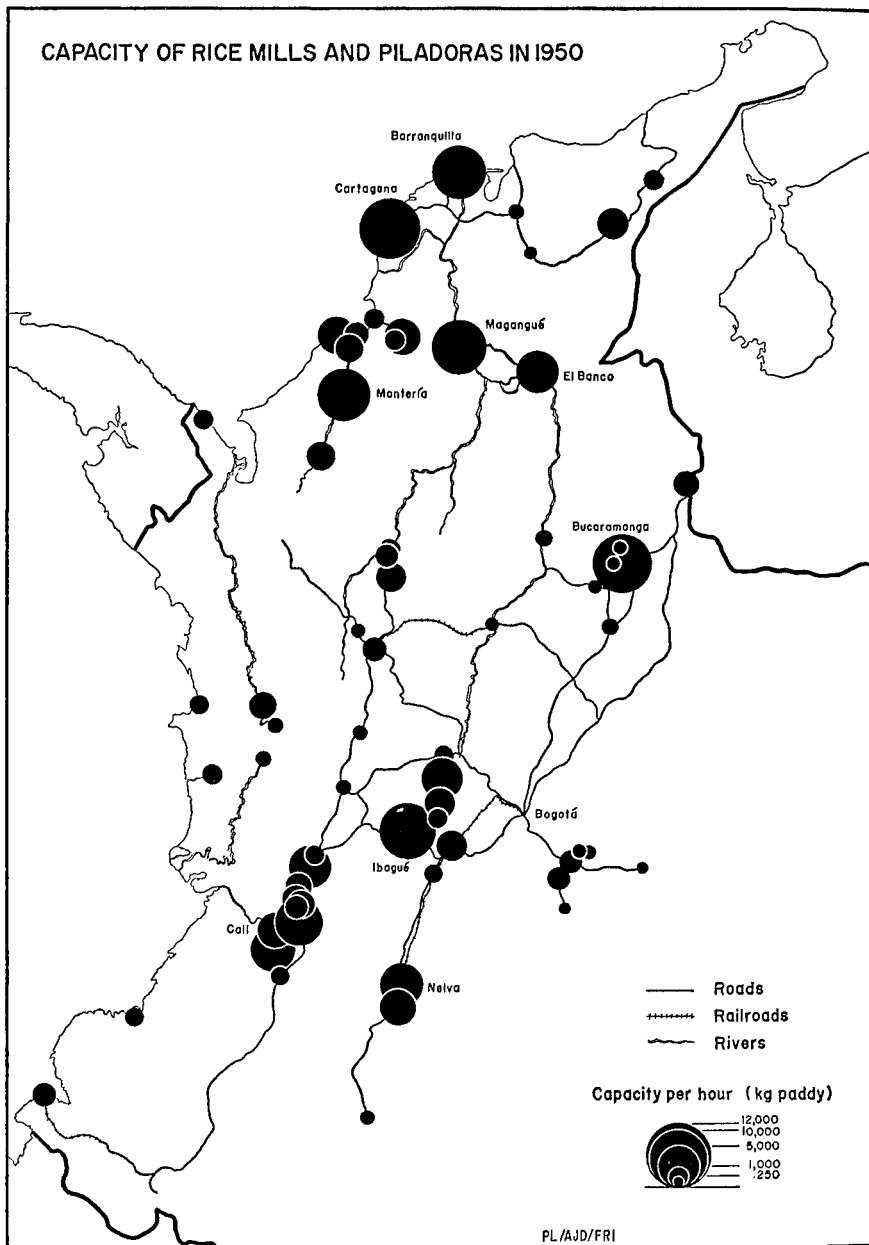
As soon as conditions were appropriate, enterprising men began to build rice mills, sometimes under the most adverse circumstances, as already indicated in Meta. It seems paradoxical that in a country where capital is so limited milling capacity constantly exceeded existing needs. The capacity of the mills in 1961 was sufficient to process three times the production of that year on the basis of the optimum of two shifts working 288 days (54, p. 18).

Milling capacity increased substantially between 1950 and 1963—from about 735 thousand tons annually in 1950 to 922 thousand in 1954 to 1,386 thousand in 1963 (not counting small concerns called *piladoras*). The mills worked more nearly to full capacity in 1963 than in 1950, and to process total national production was reckoned to require some 40 per cent of the milling capacity as against 33 per cent in 1950.

The excessive capacity was partially the result of competition between mills. Transportation costs fell; large enterprises with access to cheap power expanded

²³ Apparently the same price competition due to overcapacity existed in 1950 among the rice millers in Louisiana, with similar beneficial effects for the farmers (61).

MAP 3A.—RICE MILLS AND PILADORAS IN COLOMBIA:
LOCATION AND HOURLY CAPACITY, 1950*



* Based on data from Federación Nacional de Arroceros, *Distribución de la producción de arroz en Colombia en 1950—Informe del Gerente al III Congreso Nacional de Arroceros 1951* (Bogotá, 1951), pp. 44-54. Missing data were approximated from Federación Nacional de Arroceros, *Primer censo nacional de trilladoras de arroz* (Bogotá, 1954). Converted to rough rice equivalent at the conventional extraction rate of 65 per cent.

TABLE 8.—CAPACITY OF MILLS BY SIZE GROUPS, 1964*
(Capacity in kilograms of milled rice per hour)

Capacity size group	Number of mills	Average per mill	Capacity	
			Kilograms	Per cent
Less than 100	16	67	1,072	.5
100 up to 200	46	138	6,348	2.7
200 up to 500	86	306	26,316	11.1
500 up to 1,000	118	746	88,028	37.1
1,000 and over	74	1,559	115,366	48.6
Total ^a	340	696	237,130 ^b	100.0

* Data for number of mills and average capacity by group from *Arroz* (Bogotá), December 1964, pp. 23-24.

^a Excluding six mills for which capacities were not available.

^b Due to rounding in the published averages per mill this sum differs slightly from the published total of 236,725.

in such major rice centers as Espinal, Ibagué, Magangué, and Barranquilla. They absorbed most of the rice produced, thus cutting the supply of small mills spread over the rice-growing area (Maps 3A and B). On the other hand, the number of small mills has increased substantially in the outlying area and at the border of Ecuador, in Nariño and Putumayo, where much smuggling into Colombia occurs. With so large a number of small mills springing up in remote areas, the natural average hourly capacity per mill increased by only one-third, from 779 kilograms of rough rice per mill in 1954 (66, Table 4) to 1,071 kilograms (equivalent to 696 kilograms of milled rice) in 1964. However, Table 8 shows that the largest mills, with an average capacity of one and one-half tons per hour, now have a total capacity equal to nearly one-half the national total.

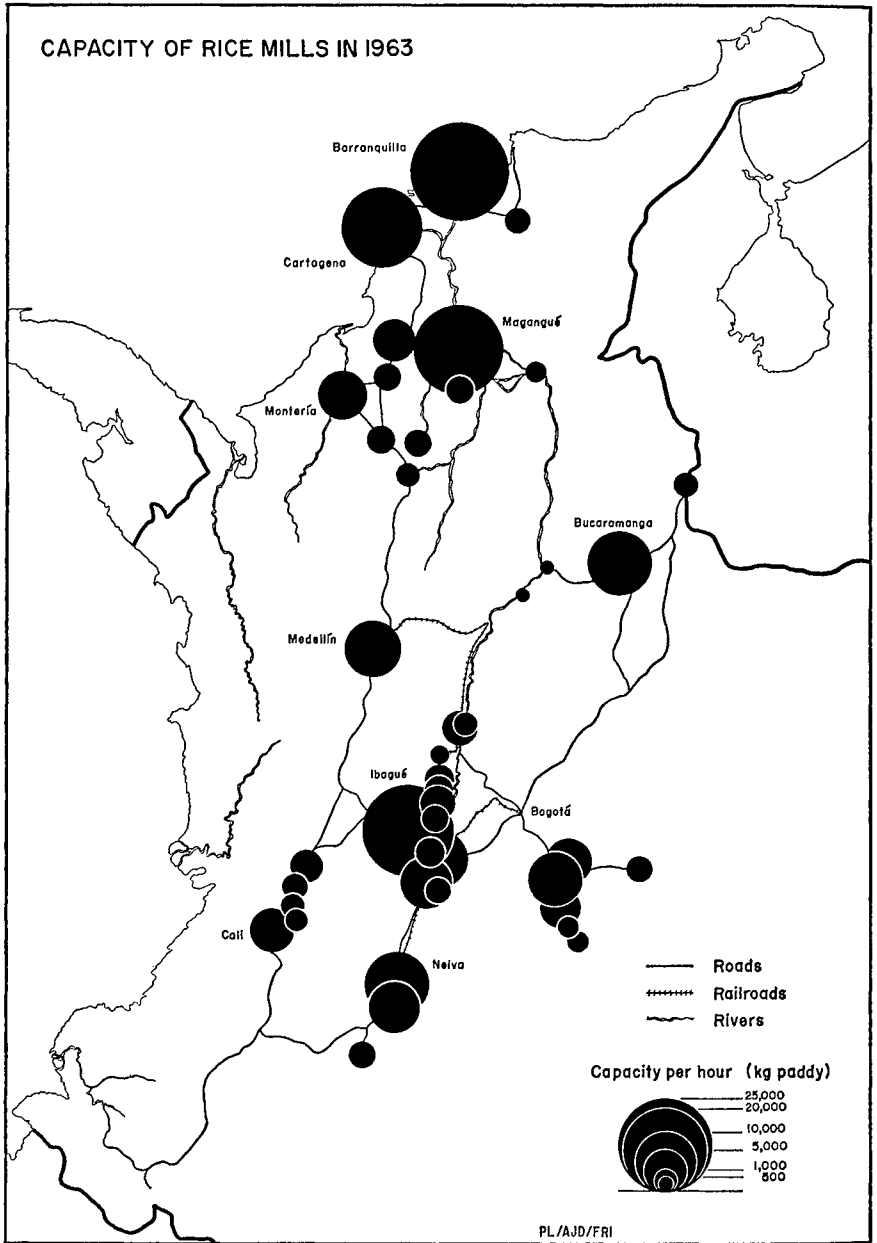
With total capacity of existing mills so large, and deficient equipment, outdated techniques, and so forth, the result was low-quality rice. In 1950 high milling losses and low quality of the milled rice were normal (25, p. 80), a situation due partly to a high percentage of red rice, low quality of mixed rough rice, and substantially to shortage of capital.

Thereafter came some improvement. In 1964 at least two mills (one in Campoalegre, one in Medellín) began to pack their products in modern one-pound cartons for direct sale to consumers in order to introduce a brand name. Although improving, the more recent milling results were not yet satisfactory. In 1961 the mills of Espinal processing Bluebonnet 50 obtained the following outputs (124, p. 2):

	Per cent
Excelso (1st quality)	51
Cristal (2nd quality)	14
Bran and meal pica	14.5
Husks	20.5

A major problem in milling springs from the use of the sun-drying process because of lack of capital. A high percentage of grain is broken or crushed when

MAP 3B.—RICE MILLS IN COLOMBIA: LOCATION AND HOURLY CAPACITY, 1963*



* Calculated from an unpublished list of mills at the end of 1963, provided by the Asociación Nacional de Molineros de Arroz, combined with capacities approximated from, or given in, *Arroz*, Vol. XI, No. 121, 1962, p. 14. Nonmember mills and all piladoras are excluded.

a tractor passes over a paved area to turn over the rice drying in the sun. The loss is considerable, as is evident in the following percentage yields (15, p. 6):

Product	Sun drying	Machine drying
Excelso (1st quality)	40	56
Cristal (2nd quality)	24	16
Cabeza (bran and meal)	16	8
Husks (implied)	20	20

Very little use is made of by-products. Rice bran and meal, for instance, are generally used by producers of feed, although it would be an excellent source of oil (104, p. 14).

Trade Margins and Price Fluctuations

Rough rice is a fairly durable commodity and easy to store. The fact that most of the irrigated paddy is produced by large farms contributes somewhat to price stability; the larger producers can store it if they feel prices are too low. Other grains, such as maize, are more subject to price fluctuation. In the central part of the country, where there is more irrigated rice, prices are less unstable than in the north, where in Bolívar, for example, the crop is exposed to all kinds of hazards. Floods may destroy the harvest. If the waters recede too soon or not soon enough, the crop may be destroyed. Rats, mice, and birds may eat what is left. These hazards enhance price fluctuation. Maize is produced on many small farms, heavily dependent on credit. To pay their debts, small farmers have to sell their surpluses promptly after harvest, thus tending to accentuate seasonal variations in price.

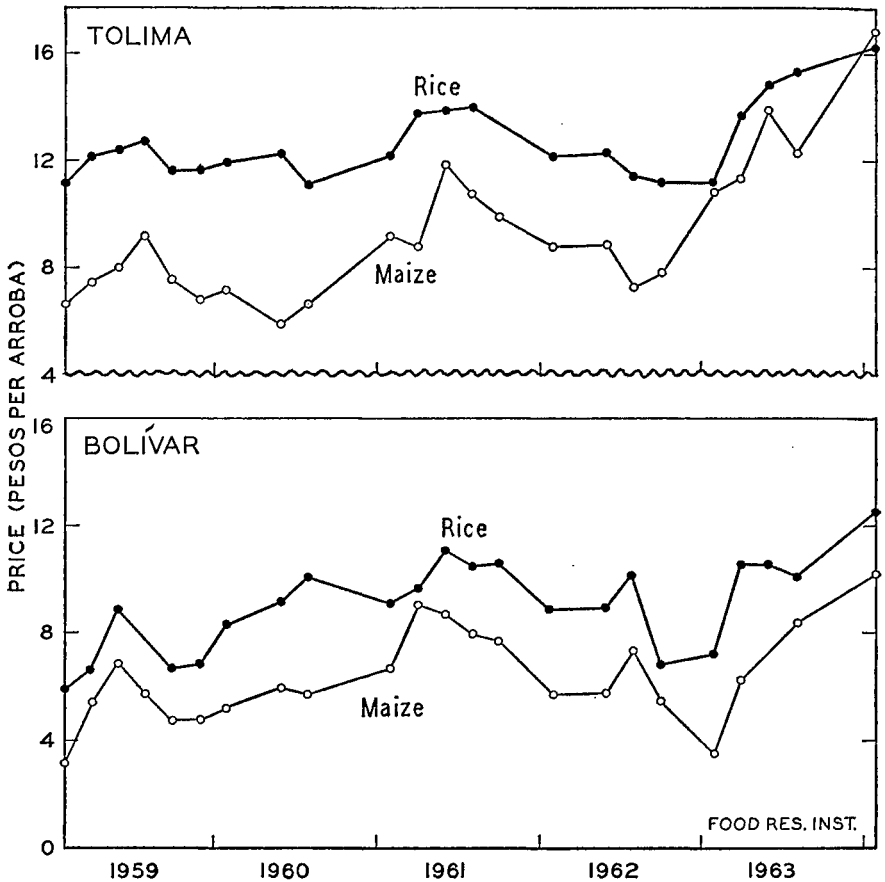
Chart 5 and Appendix Table IV show the much wider price movements recorded for maize than for rice in Tolima and Bolívar during 1959-63. If we take into account the devaluation of the peso in December 1959 and the subsequent increase of 35 per cent in commodity prices in general, paddy prices in Tolima were fairly stable. Even if we take into consideration regional differences in maize varieties, the greater magnitude of the price changes for maize still remains impressive. This would seem to be a good reason for modern farmers to avoid maize growing if attractive crop alternatives are available.

At wholesale, the prices for other foods produced by small farmers are similarly subject to wide fluctuations, both seasonally and from year to year (Appendix Table V). Thus between 1959 and 1960 prices for noncentrifugal raw sugar in real terms decreased one-fourth, and price fluctuations for potatoes are a source of constant concern to the Colombian government.²⁴

In the rice trade, particularly the supply of the capital city and other urban centers, competition is considerable. Rice flows through different channels from mills in Meta, from Tolima, and also from the northern part of the country. Despite the unstandardized volumetric measures existing in Colombia, making quick comparisons difficult for traders, the fierce competition between them and between various trade channels keeps margins down. Transportation is not

²⁴ During the first months of 1964 the price of the potato variety *sabanera de primera* exceeded 200 pesos per *carga* (125 kilograms). The government then promised solemnly to support prices to encourage production. In October 1964 the price for the same variety slumped to 40 pesos.

CHART 5.—PRODUCERS AVERAGE PRICES FOR ROUGH RICE
AND MAIZE IN BOLÍVAR AND TOLIMA, 1959-63*
(Pesos per arroba)



* Midmonth average prices as shown in Appendix Table IV, which also gives maximum prices.

excessively costly. In 1959 it amounted to only 4 per cent of the price paid by the consumer for rice supplied from Tolima.

The trend of wholesale rice prices in Bogotá has very roughly paralleled that of the cost-of-living index (Appendix Table V). Deflated prices of rice were lower in 1964 than in 1945 particularly if we take into account that present-day standards of quality are considerably higher.

The retail margins on the Bogotá market are moderate—about a tenth of the price paid by the consumer, more only in times of soaring prices. Bogotá has a considerable number of retail outlets. One of the peculiar features of this city is the large number of small stores set up in garages that are rented to petty traders by people who cannot afford a car. These stores sell small quantities of foodstuffs such as potatoes, fruit, canned goods, and rice. The trade channels for the rice supply in Bogotá are efficient.

At all levels the considerable improvement of marketing conditions has con-

tributed to the sustained growth of production in the central rice belt, despite an apparent reduction of producer's margins.

REGIONAL PATTERNS OF CHANGE

Colombia has wide expanses of two major types of land suitable for rice production: open savannas in the foothills of the mountains with a relatively dry climate, and rainy and swampy areas in the western, northern, and eastern parts of the country. Only a small portion of these resources has been utilized. In the dry savanna, irrigation requires considerable capital. In the remote regions there is a lack of transport and marketing outlets.

In some areas, as in the middle Magdalena Valley, growth and progress of production have been notable; in others, such as the lower basins of the rivers flowing into the Pacific, stagnation prevailed despite excellent alluvial soils, natural irrigation, and adequate drainage.

Why were modern methods of production and inputs introduced in some areas at a remarkable pace but not in others? What was the impact of government policy on growth and progress of production under varying local ecological conditions? In what way were increasing emphasis on certain types of farming and progressive modernization of production the effect of vacillation in national policy on the availability of production factors locally? The major changes in location of production can be seen; but the available figures are approximate and lack consistency.

Irrigated farming areas are close together and largest in hectarage in a few departments—Huila, Tolima, and Valle (Table 9). In other departments, centers of irrigated and of unirrigated rice are far apart. Thus close to Cúcuta in Santander, rice is grown by large growers under irrigation, whereas in the forested northern part upland rice is grown by small farmers. The same contrast can be found in Magdalena.

Gradually the main centers of rice production have shifted from the north where low-yield varieties were grown on the river banks and transported by boat to the markets on the north coast. The shift was first to the irrigated areas of Huila, Tolima, Cundinamarca, and Caldas, then more recently, as appears in the following tabulation, to the eastern Llanos where cheap land was and is available. Regional percentages of the national rice harvest were as follows (3, 14, and unpublished records of the National Federation of Rice Growers):

Area	Type	1934	1949	1963
Northern Colombia Antioquia, Córdoba Bolívar, Atlántico	Unirrigated	52	28	17
Eastern Llanos Caqueta, Meta	Mainly unirrigated	5	6	14
Middle Magdalena Valley Huila, Tolima, Cundinamarca, Caldas	Irrigated	11	35	40
Cauca River Valley Cauca, Valle	Mainly irrigated	13	15	10
Other areas	...	19	16	19

TABLE 9.—PATTERN OF ROUGH RICE PRODUCTION IN 1959*

Department	Total				Per exploitation	
	Number of farmers	Area (hectares)	Production (tons)	Yield (kg. per hectare)	Area (hectares)	Production (tons)
MAINLY OR TOTALLY IRRIGATED RICE						
Huila	315	9,432	27,570	2,923	29.9	87.5
Tolima	1,438	27,104	78,525	2,897	18.8	54.6
Valle	271	14,910	35,441	2,377	55.0	130.8
IRRIGATED AND UNIRRIGATED RICE						
Caldas	402	2,483	4,914	1,979	6.2	12.2
Cauca	542	3,639	7,714	2,120	6.7	14.2
Cundinamarca	471	6,535	14,278	2,185	13.9	30.3
Magdalena	3,196	15,389	34,145	2,219	4.8	10.7
Norte de Santander	1,324	7,194	14,494	2,015	5.4	10.9
MAINLY OR TOTALLY UNIRRIGATED RICE						
Antioquia	4,614	17,017	22,950	1,349	3.7	5.0
Atlántico	258	408	570	1,397	1.6	2.2
Bolívar	10,082	23,841	31,185	1,308	2.4	3.1
Boyacá	2,704	10,620	14,269	1,343	2.3	5.3
Córdoba	14,528	33,937	44,789	1,320	2.3	3.1
Meta	4,302	26,969	37,705	1,398	6.3	8.8
Nariño	5,508	10,158	13,317	1,311	1.8	2.4
Santander	3,328	17,156	25,290	1,474	5.2	7.6
Census total ^a	53,283	226,792	407,156	1,795	4.3	7.6
Federation ^b						
Above departments	...	190,500	390,200	2,048	...	...
National total	...	205,800	422,100	2,051	...	...

* Data from Colombia, Departamento Administrativo Nacional de Estadística, Directorio Nacional de Explotaciones Agropecuarias, *Censo agropecuario, 1960: resumen nacional*, Pt. 2 (Bogotá, 1964), p. 26.

^a The Census gives no data for Chocó, Caqueta, Guajira, and the rest of the country.

^b Unpublished data of the National Federation of Rice Growers.

Departments distant from main consumer markets, such as Nariño bordering Ecuador on the Pacific beyond the Western Cordillera, and Chocó and those that use traditional methods of cultivation such as Antioquia, Bolívar and Córdoba in the northwest, have decreased in importance. Except in the Cauca Valley area, which is subject to acute crop competition, irrigated areas have maintained the growth initiated before 1950. The eastern Llanos have played an increasingly significant role and new irrigated areas have been developed, mainly in the César-Ariguani Valley in the northeast near Venezuela.

Many changes occurred with revolution in transportation. A rice belt around Tumaco in the far southwest dwindled in importance simultaneously with the dismantling of the Tumaco-El Diviso Railway; the western region of Santander experienced an increase in upland rice production with the advance of the settlement frontier along roads and the Atlántico Railway.

Maps 2A and B (pp. 230, 232) show estimated distributions of acreage in 1932 and 1959. Shifts resulting from the development of transportation are evident;

in Boyaca the location of rice-growing areas changed noticeably with expansion of means of communication in Territorio Vasquez. With improvement of the road system southern Córdoba as well as the border regions between Norte de Santander and Magdalena were incorporated into the marketing structure of the country. The areas of upland rice production indicate roughly the location of frontier settlements, for usually the first crop grown by settlers after clearing is this type of rice.

Changes in acreage and yield of both irrigated and unirrigated rice explain the general trend in the rice industry. Analysis is possible only for the last decade for which sufficiently precise data are available, and that is not complete. In 1954 the Federation published its first estimate of acreages and yields for irrigated and unirrigated rice. At that time national production was estimated at 294,850 tons; it has since increased, though irregularly, reaching 585,000 tons in 1962 and 550,000 in 1963 (Table 10), and new heights are in sight.

Table 11 gives the development of production in major regions between 1954 and 1963. For changes in acreage and yields for irrigated and unirrigated rice see Appendix Table II.

Development has been particularly pronounced in three departments, Tolima, Meta, and Magdalena, which account for half the total increase in production; four other departments, Huila, Valle, Caqueta, and Norte de Santander, account for another fourth. Two-thirds of the increase in national production came from

TABLE 10.—PRODUCTION OF ALL RICE IN COLOMBIA BY DEPARTMENTS,
1954 AND 1963*

Department	Tons			Rank	
	1954	1963	Increase	1954	1963
Tolima	74,150	141,000	66,850	1	1
Meta	22,100	56,250	34,150	5	2
Magdalena	11,600	38,650	27,050	8	7
Huila	22,000	47,300	25,300	6	3
Valle	24,600	41,100	16,500	4	4
Caqueta	3,500	19,450	15,950	16	8
Norte de Santander	5,800	18,000	12,200	13	11
Córdoba	29,500	39,900	10,400	3	5
Santander	9,000	19,100	10,100	10	9
Cundinamarca	10,300	18,600	8,300	9	10
Boyaca	2,600	9,150	6,550	18	15
Bolívar	34,000	39,600	5,600	2	6
Antioquia	8,600	13,250	4,650	11	13
Caldas	7,700	12,300	4,600	12	14
La Guajira, Putumayo,					
Amazonas	5,000	9,100	4,100	14	16
Chocó	4,500	7,400	2,900	15	17
Nariño	3,000	4,100	1,100	17	18
Atlántico	200	800	600	19	19
Cauca	16,700	14,950	-1,750	7	12
Total	294,850	550,000	255,150	...	...

* Data from Appendix Table I.

TABLE 11.—DEPARTMENTS WITH 1954 TO 1963 INCREASES IN PRODUCTION OF ALL RICE IN EXCESS OF 10,000 TONS*
(Tons rough basis, except as otherwise indicated)

Department	Production 1963	Increase in production 1954 to 1963		
		Unirrigated rice	Irrigated rice	Total
Tolima	141,000	600	66,250	66,850
Meta	56,250	25,550	8,600	34,150
Magdalena	38,650	1,050	26,000	27,050
Huila	47,300	—	25,300	25,300
Valle	41,100	600	17,100	16,500
Caqueta	19,450	13,300	2,650	15,950
Norte de Santander	18,000	800	11,400	12,200
Total	361,750	40,700	157,300	198,000
Per cent of national total	65.8	49.4	91.1	77.6

* Based on Appendix Tables I and II.

irrigated areas, mainly because of new investment for expanding irrigation. While yields per hectare in irrigated areas increased from 2,690 to 2,981 kilograms, it was only by 11 per cent.

As far as can be seen, the introduction of modern techniques, notably the use of herbicides and agricultural machinery, into the areas of upland rice production accounts for a substantial increase in yields in specific areas, although for this type of farming the natural hazards are such that a comparison for two years only does not afford firm conclusions. In some areas striking improvement occurred—for instance, in Mariquita in extreme northern Tolima, where rice was produced as early as 1580 to provide food for gold miners. In this area average yields of upland rice reached three tons per hectare in 1963, twice the national average.

Regional comparisons reveal that the largest increase in upland rice occurred in the eastern Llanos and the largest in irrigated rice in the middle Magdalena Valley (Huila and Tolima), Magdalena, and Valle. These areas account for seven-tenths of the total production. They form three main groups: long-established irrigation areas, e.g., Cauca Valley, Huila, and Tolima; new areas of irrigated rice such as Magdalena; and new centers of upland rice production with modern methods, e.g., Meta and Caqueta. This does not, however, give the complete picture. Such events as the reorganization of production within specific departments, as for instance in Córdoba, local shifts within the same department and same type of production as in Valle, and the importance of alternatives, are not shown (Table 11).

A more detailed analysis of factors of change and trends by selected regions sheds additional light on the pattern of progress. Three regions of markedly different characteristics may be mentioned. In the first, represented by the middle Magdalena Valley, alternative land uses are limited; land rents and prices are high, forcing technical progress, a trend most evident in Huila. Government investments and good marketing facilities have created a modern industrial structure, hospitable to technical advance.

A second region, comprising the frontier of modern rice growing, where modern techniques were introduced as soon as transportation facilities improved and personal security was assured, covers the César-Ariguani Valley and the eastern Llanos.

Improvement due to modernization was slower in a third region, Valle and Córdoba; alternative land use within the irrigated areas was possible and bottlenecks originated from the limited availability of production factors, restricting rice production or pushing it to remoter areas.

Elsewhere, the changes resulted generally from modifications in the network of transportation. In the south and west, the rice-growing area of Nariño was penalized by dismantling of the railway; and Chocó depends as before on river launches. But the Atlantic Railway has opened new areas in Santander and southern Magdalena.

Classification of rice growing into these categories, though not sharply drawn, provides a framework for an explanation of the interrelationships among several factors: protectionism, introduction of modern tools and cultivation methods, decrease in relative costs, and shifts in location.

Huila and Tolima

A very specific pattern of development seems to recur in Colombian agriculture. Temporarily favorable circumstances in an area are followed by development of new plantations and introduction of new crops. After an initial spurt nature takes its revenge. Weeds, plant diseases, and pests spread, the soil is depleted, and the venture becomes unprofitable. Farmers then shift to a new location. In both Huila and Tolima, home of the modern rice industry, rice production underwent the first two phases of this cycle, and then important new factors intervened. Landowners and farmers struggled hard and successfully to restore soil fertility. On the other hand, population pressure, high land prices, and political disturbances sent some growers to new areas. Modernization accompanied them to other areas where land was cheaper, mainly the eastern Llanos and the César-Ariguani Valley in Magdalena.

As noted above, irrigated rice was brought into Huila half a century ago. Some communities there produce Colombia's best rice, using the most elaborate tools and methods of cultivation. Yields in this department were the highest in Colombia in 1962. Average yields on irrigated land were 2,822 kilograms per hectare for the whole country but 3,208 kilograms per hectare in Huila; similarly in 1963 average national yield under irrigation was 2,981 kilograms per hectare but that of Huila, 3,428 kilograms.

Good management, not new in this department, is particularly noticeable in the heart of the rice belt of Huila in Campoalegre. The advanced state of rice production in Huila has been pointed out by all visiting foreign technicians.²⁵ A Brazilian technician noted that sooner or later Huila would become the seedbed for modern rice growers all over Colombia, since scarcity of suitable land would force Huila growers to migrate; and so it was (25, pp. 89 ff.). The tradi-

²⁵ As early as 1951 Huila rice growers, noticing that flooded areas gave the highest yields, introduced irrigation by submersion though at that time they had not yet mastered the technique completely. They used the best seed, classifying and selecting them before seeding.

tion of the Huila rice growers has been maintained and they continue to use the best seed.²⁶ Young men migrated to new rice-growing areas, where they contributed significantly to the introduction of technical improvements. In 1951 people from Huila were already engaged in development of the newly opened Saldaña project near Espinal in Tolima (130, p. 1). Now people from Huila can also be found in Meta, Magdalena, Guajira, and other parts of the country.

A short history of the rice industry in Campoalegre in the heart of Huila will explain this migration. Campoalegre is located some 35 kilometers south of Neiva, where the upper Magdalena Valley begins to widen. When one large cattle ranch in southern Huila was divided up in the 1890's, most of Campoalegre became the property of one powerful family. The landowner introduced rice and was imitated by neighbors. The ox plow was introduced, rice was hand seeded, and threshing was done by teams of oxen stamping the rice stalks. Waste was inevitably enormous and yields were only 750-950 kilograms per hectare. Pressure of population on land available for rice growing somewhat decreased in 1936 when the government acquired an estate of 2,000 hectares and divided it among landless peasants.²⁷

During World War II irrigation canals were dug, thus increasing total acreage. The use of threshing machines, after the first came from Valle in 1929, became common. Successive improvements were introduced and generally adopted. One farmer utilized Chilean nitrate as early as 1946 and obtained substantial further increase in yields in 1952 when he pioneered in the use of fertilizers imported from France by the Rice Federation.²⁸ However, the rate of introduction of improvements was directly related to economic pressures.

In 1951, the opening of the Saldaña irrigation project released pressure on land; rice growers came to find new land under irrigation and better yields per hectare (130, p. 1). In 1954 the opening of Coello, also near Espinal in Tolima, provided other opportunities for Huila growers. In the rice belt of Campoalegre soil was progressively depleted and pedologists hypothesized that it was better suited for other crops, such as tobacco and cotton (73, p. 240).

Most of the rice in Huila had been grown by tenants who try to obtain a maximum return within the shortest possible time. For years few of them tried to maintain fertility at an acceptable level, nor did they do much about fertilizers or rotation of crops, about washing out mineral salts, or about using the basin method rather than allowing top soil to wash off with flowing irrigation (132, p. 54). Extensive areas once in rice were transformed into unimproved pasture. In 1956 mechanization developed when no alternative land use was available. But since 1959 the consumption of fertilizers has expanded considerably, land rents increased (Chart 6), which in turn forced farmers to continue to use fertilizers (45, pp. 27-44).

In 1959, 87 farmers among approximately 140 used mineral fertilizers; the community owned 75 tractors and 73 farmers used a combine.²⁹ All these

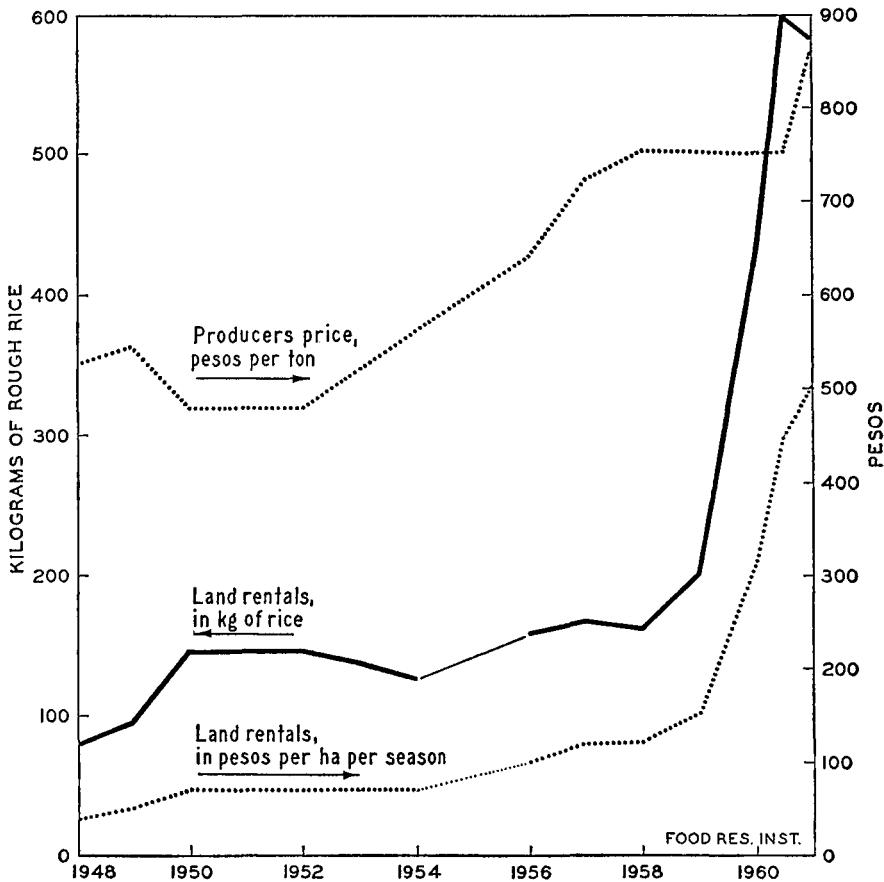
²⁶ When in 1961 Colombia imported 187 tons of seed of the Bluebonnet 50 variety, 112 tons of it were for Huila (46, p. 650).

²⁷ Information obtained from the manager of the rice mill Florhuila, Campoalegre, April 19, 1964.

²⁸ The results of fertilizer application were overwhelming, twice as high a yield and a lower percentage of milling loss (49, p. 233).

²⁹ Census data not yet published. See 33.

CHART 6.—LAND RENTALS IN CAMPOALEGRE EXPRESSED IN KILOGRAMS OF RICE AT THE AVERAGE ANNUAL PRODUCER PRICE 1948-61*



* Land rentals in current pesos per hectare in Campoalegre are from Colombia, Ministerio de Agricultura, *Memoria del Ministerio de Agricultura al Congreso Nacional—1961* (Bogotá, 1962), p. 36. Producers' prices of rough rice are as described for Chart 2, before deflation. Rents in kilograms per hectare are calculated.

machines were used in the rice-growing part of the community which encompassed 70 per cent of the population. By 1961 the conditions prevailing in 1954 had completely changed in Campoalegre. Even the descendants of the Ota Indians used fertilizer; large farms used 400 kilograms per hectare, small farms about 300 kilograms. Improved seed, combines, and insecticides were in general use (45, p. 40). This shift to modern methods was induced by the availability of well-equipped tenant farmers and scarcity of irrigated land. It was followed by rental increases.

In 1961 only 9,000 hectares of a total of 17,903 hectares of flat land in Campoalegre were devoted to rice growing. In the same year only 7,900 hectares of all the land were irrigated, one-half for each growing season. Rice occupied only 22.1 per cent of the flat land, the low figure reflecting the high capital input necessary to develop irrigation projects and the limited availability of water. Consequently, rice has been rotated with pasture, and land under cultivation

shifted after each season. Only some 2,000 hectares of the 7,900 hectares are utilized by owners. This includes not only about 20 hectares of land owned by 15 members of the Ota tribe, but also three large farms with large capital investment and heavy machinery, using the best methods on 500 to 600 hectares per season. The bulk of production comes not from owner-operators but from the approximately 6,000 hectares rented to tenants. Four major agents are involved in this type of rice production: the landowner, the tenant, the machinery operator, and the labor teams.

Increased use of machinery has naturally tended to expand the optimum size of farms, thereby increasing competition among tenants. But use of fertilizers, forced by the tendency for yields to decline, has brought about increased yields and profits, a considerable part of which have been passed on to landowners through rise in land rentals. This was not the only windfall gain for the landowner. A rotation system of alternate pasture and rice growing provides very good pastures; without any expense landowners could induce possible future tenants to accept the obligation to seed grass in paddy fields following the rice harvest. And in order to be sure to get the land, tenants had to pay the full amount of land rental five months in advance.

Some farmers who bought machinery in good years are outbid for use of land but in order to make a living need urgently to plant at least one crop per year. On the other hand, some land-endowed tenants can not afford unmechanized production or low yields. Therefore, owners of machinery without land associate with land-endowed tenants in different types of *compañía* or partnership, under conditions known only at the last minute, for the tenant has the opportunity to select his associates among numerous candidates.

Laborers have seen their working time shortened year after year as much of the work has become mechanized, diking excepted. Enough work is available only during the first two or three weeks of planting, when dikes have to be built partitioning the fields. This work, for which Campoalegre laborers are known throughout Colombia, is organized by contractors who employ teams and pay them well, though for a very short time. Day after day during the growing period the contractor gradually dismisses workers he no longer needs. The labor required decreases from nine working days per hectare to one working day per 10 hectares. Technological progress also continually diminishes the demand for labor, and the last remaining group of workers is now in process of being eliminated by technical change. Water is so precious that it pays to level the paddy fields with tractors; and this improves fertility, notably because silt from the water of the Neiva River is deposited, and also increases the acreage that can be used. Leveling would eliminate the need for the teams of laborers currently used for building and maintaining dikes at different contour levels.

Since the mills at Campoalegre do not run at capacity, they offer rice growers considerable assistance in the form of credits and selected seed in exchange for the obligation to deliver them. Transportation costs have also encouraged the production of quality rice fetching premium prices; this in turn contributed through competition to an improvement of milling methods. It is one of the mills in Campoalegre which packs rice in one-pound boxes, seeking premium prices. Such an environment is conducive to rapid progress. High land prices

warrant the use of modern techniques and justify new investments. On the other hand, such capital intensification limits opportunities for agricultural workers and dike builders. Many with special skills feel obliged to migrate, and their knowledge thus spreads throughout the country. Contractors from new areas with expanding rice cultivation, such as Magdalena, travel to Campoalegre to recruit qualified laborers for the construction of irrigation ditches. Travel expense is paid to the new place of work, and workers receive a good wage. But they generally fail to accumulate enough money to return to their place of origin, so that migration becomes permanent (45, p. 40).

Increased prices of irrigated land prompted new irrigation schemes at higher altitudes.⁸⁰ Owners plant leguminous crops as green manure in the fallow season. Campoalegre is today one of the most progressive rice-growing areas in Colombia, providing leadership and skills to other parts of the country.

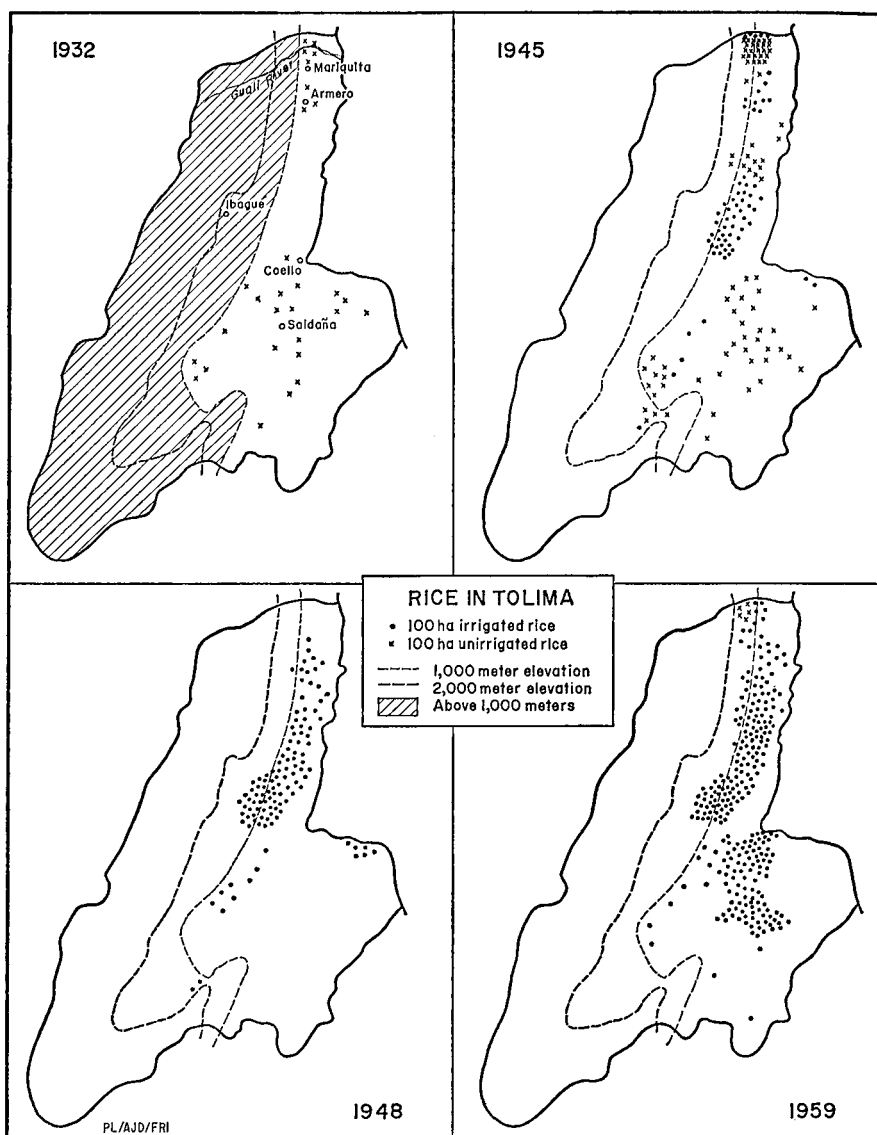
In 1933 Spaniards settled on the banks of the Guali River in Mariquita (extreme northern Tolima) and planted rice. A high position in rice production achieved then has since been maintained. The department of Tolima ranks highest in rice production in Colombia, with about one-fourth of total national production. It is also the department where the National Federation of Rice Growers began its activities and, after Huila, the area where improved methods of cultivation were introduced most rapidly.

The location of rice production in Tolima has undergone several shifts since 1932. First to be developed was the north of the department (see p. 227 and Map 4). The typical boom and slump, so familiar in Colombia, developed. The soil was soon depleted and poisoned by sulfuric salts in the waters of the Guali River. Between 1935 and 1950 rice expanded mainly farther south, in the neighborhood of Ibagué and the stretch Ibagué-Armero. And when the Saldaña and Coello irrigation projects financed by the Export-Import Bank were inaugurated in 1951 and 1954 respectively, rice moved southward into the central part of the department. In Ibagué, Coello, and Saldaña the development was typical for Colombia. At a given moment rice was grown by almost every farmer, and then land rentals rose. Techniques of cultivation did not keep pace with the rise in land values and in costs, the soil was exhausted, and migration began. But unlike the pattern elsewhere, only minor shifts in land utilization took place: competition with other crops did not eliminate irrigated rice as happened with upland rice. Rice producers organized, fought against nature, and succeeded in reorganizing rice production on progressively depleted soils despite continuously increasing costs of production, particularly after the peso devaluation of 1957. They succeeded despite high land rentals, competition with cheaper locations, and a relative decrease in prices.

In Mariquita expansion of irrigation stopped in 1945, in Ibagué around 1952, in Saldaña around 1954, and in Coello around 1956. In 1945 the acreage under irrigated rice had been estimated at 7,555 hectares as compared to an estimated 7,069 hectares under upland rice. But upland rice disappeared throughout Tolima mainly because of high wages and high land rentals. Land rentals were low in

⁸⁰ In 1959 there were new irrigation projects all over Huila, three of which significantly increased the acreage under rice, El Hobo with 3,000 hectares, Yaguara with 1,800 hectares, and Carnicerías (116, p. 32).

MAP 4.—LOCATION OF RICE CULTIVATION IN TOLIMA, 1932, 1945, 1948, AND 1959*



* Data for 1932 from Colombia, Ministerio de Agricultura y Comercio, *Memoria del Ministerio de Agricultura y Comercio al Congreso Nacional en sus sesiones ordinarias de 1934*, Tomo III (Bogotá, n.d.); for 1945 from L. G. Correa O., *Como se cultiva el arroz en el Tolima* (thesis, Universidad Nacional de Colombia, Facultad de Agronomía, Medellín, 1952); for 1948 from a report by Emilio A. Fortoul quoted in Raúl Varela Martínez, *Arroz* (Ministerio de Agricultura, División de Economía Rural, Bogotá, 1949), unpublished, mimeo, p. 34; for 1959 preliminary unpublished data from the 1960 Census.

1945. Small landholders or tenants cultivated plots averaging less than 10 hectares, seeding by hand and harvesting with scythe or a machete. Even with such primitive methods rice cultivation was profitable because of high rice prices (56, p. 7).

Given the low land rentals and the ecological conditions, expansion of rice

production around Ibagué was rapid before 1952. This *meseta* is rather stony and dry, most of the precipitation occurring on the opposite (western) side of the Central Cordillera. Under a thin layer of arable soil (10 to 15 centimeters) is a stratum of heavy clay and stones. Up to 1936-37 this land had been used for extensive grazing only, a single head of cattle requiring as much as 10 hectares of pasture. The pastures were fenced by stone walls built by Spaniards centuries ago. Little creeks flowed through the area. In the absence of crop farming, the price of land was only about 10 to 15 U.S. dollars per hectare when rice was introduced, and land rentals were low. It was a rather costly enterprise, however, to clear away rocks and stones in order to mechanize cultivation. Fortunately water requirements were low—one liter per second per hectare as compared with three liters in Armero (91, p. 14). The altitude of the area (3,600 feet) militates against plant diseases and pests common to the tropics. The environment was ideal for rice cultivation.

In 1949 a farmer who had cultivated rice since the thirties, estimated the cost of production of rice at 400 pesos (1949 value) per hectare and the selling price of a harvest of 650 kilograms of milled rice at 832 pesos, so that the profit was 432 pesos before payment for water, which must also be included in the production cost. Three harvests were obtained in two years, at a water cost of 300 pesos. Under such conditions the net income of the landowner per year was nearly 500 pesos per hectare, ten times the returns on the same land without irrigation or mechanization (32, pp. 11-14). These enormous profits with yields as low as 1,000 kilograms of paddy per hectare explain why farmers took the trouble to clear the land of rocks and stones (25, p. 88). But such factors as increasing water shortage, depletion of marginal soils, invasion by weeds and red rice, increasing land rentals, and higher costs for land clearing caused rice to disappear in some areas. By 1959 only 4,967 hectares were harvested in Ibagué.³¹ Water costs also became increasingly heavy. In Ibagué in 1952 some farmers invested as much as half a million pesos to obtain a flow of one cubic meter of water per second (115, p. 154). Diversion of water and individualism of many holders of water rights caused much land to lie unused that could have been cultivated under irrigation.

During the period of prosperity, increasing land rentals led landowners to rent their land for shorter periods of time. Rentals might amount to as much as a fourth or even a half of gross production. While tenants made good profits under such conditions (56, p. 4), they were naturally more interested in quick returns than in soil conservation. They wasted water resources and washed away soils by using the soil-destructive though capital-saving method of gravity-flow irrigation (*riego corrido*). Rice production ceased to be profitable on many farms. The application of costly fertilizers was one alternative, the shift to a new area another.³² The conditions in Tolima, as in Huila, led to rapid occupation of newly developed areas, to a temporary pause in activity in land renting, and to a return to cattle farming on irrigated land where rice cultivation no longer paid.

³¹ Census data, not yet published.

³² In 1952 a farmer owning two farms, one in Lérída and one within the reach of the Saldaña irrigation project, obtained the following yields: in Lérída 15 to 20 bags of rice on depleted soil unfertilized, 35 bags fertilized; and in Saldaña 35 to 60 bags without fertilizers (56, p. 54).

The Coello and Saldaña Irrigation Project

The history of the Coello and Saldaña irrigation project—the largest of its kind developed by the Colombian government—is a story of trials and errors, of costly attempts and serious setbacks. The fact that this project has proved to be of positive value despite all the obstacles that had to be overcome shows the importance of the role played by irrigation in the foothills of central, northern, and western Colombia.

The idea of irrigating the almost useless “steppes” of Saldaña had been conceived by private landowners long before World War II. A public official who was also a farmer early tried irrigation in Espinal, southwest of Bogotá in Tolima (93, p. 2). Interest in these projects was stimulated by Japan’s invasion of south-east Asia. In 1943 a canal, 7 kilometers long, was dug in the Coello area slightly farther north; but a year later the project was abandoned due to lack of funds (76, p. 7). At that time the American government was anxious to give assistance to Colombia, and on December 30, 1943, an agreement was reached between the Colombian government and the Export-Import Bank regarding preparation of studies which would eventually lead to the financing of irrigation projects (47, p. 94).

Colombian technicians, together with members of the American Agricultural Mission in Bogotá, collected data on soils, rainfall, costs, and marketable products. A member of the Export-Import Bank’s technical staff prepared a report on the feasibility of the projects. For the Coello area he estimated a net production of 878,000 current pesos for 1945 (3.5 million pesos at 1959 prices). He estimated gross production before and after completion of the project at 2.67 million pesos and 13 million respectively (1945 prices).

The results of the project have indeed been satisfactory. In 1950, before the introduction of irrigation, gross production in Coello, calculated in 1959 prices, was 16 million pesos. By 1959 it had increased to 40 million pesos, although over this period of time a shift in the commodities produced had taken place. Studies of soils had suggested prior to 1945 a line of production as indicated in the second column of Table 12, but as seen in the final column the outcome, in 1959, was different, as dictated by economic conditions. There was notably less pasture than anticipated, but much more cotton and sesame and especially more rice. Rice was first grown under irrigation in the Coello district in 1954. Supported prices for rice, cotton, and sesame contributed to the results. In Saldaña also, while area devoted to pasture did not decline between 1949 and 1958/59 and that in sesame fell somewhat, there was a large increase in rice and in cotton acreage (36, p. 27). A comparison of rentals and prices of land in irrigated and nonirrigated areas suggests a very high rate of return in spite of numerous setbacks suffered through inexperience or institutional deficiencies (Appendix Table VI).

Saldaña, second to be studied, was the earlier irrigation project to be inaugurated. Before 1948 the area was virtually unexploited. Half of the land was covered with brush and dry weeds, 40 per cent was used for extensive farming, and only 10 per cent was planted to plantain, sesame, cotton, maize, and upland rice. Rainfall was very irregular, and in the principal (summer) dry season the area was completely dried out. Tenant farmers lived in mud or straw huts

TABLE 12.—LAND USE IN THE COELLO AREA, SPECIFIED YEARS 1945-59*
(Hectares)

Land use	1945	Expected after completion of project	1950	1959
Pasture	12,800	9,600	9,200	3,500
Maize	960	1,600	2,300	—
Cotton	960	1,600	3,100	4,000
Sesame	320	640	4,000	4,500
Tobacco	320	640	1,000	1,000
Manioc	320	320	200	—
Plantain	...	160	500	—
Rice	...	960	—	11,650
Beans	...	245	—	—
Fibers	—	160	—	—
Miscellaneous	320	75	—	—
Total	16,000	16,000	20,300 ^a	24,500 ^b

* Data for 1945 from S. P. McCasland, *Anteproyecto—irrigación Río Coello (Espinal)* (Bogotá, Imprenta Nacional, 1945), Parte B; for 1950 and 1959 from Colombia, Caja de Crédito Agrario, Industrial y Minero, *Informe financiero económico y social sobre el estado de los distritos de irrigación de Coello y Saldaña en el Tolima* (Bogotá, 1960), p. 26.

^a Double cropping on one-third of the acreage.

^b Double cropping on 54 per cent of the acreage.

and generally worked in *compañía* with the landowner, in this way paying their rent (36, p. 1).

The Coello area also (see Map 1, p. 219) is characterized by a hot tropical climate and very irregular rainfall. Before 16,000 hectares of it were irrigated, 3,400 hectares were held by six *latifundistas*, the remaining 12,600 hectares being divided among 2,500 farmers. Cattle farming utilized 12,800 hectares and was the most important source of income, yielding 288,000 pesos; cotton brought a net income of 230,000 pesos, and tobacco, 192,000 pesos. These three products yielded three-fourths of the total value of production.

As a result of its McCasland Report (98, p. 58) the Export-Import Bank granted Colombia a first loan of 10 million U.S. dollars for construction of the Coello and Saldaña projects, the Sisga dam in the Sabana of Bogotá and the Sinbunday Valley drainage project far south in Nariño department. In 1953 a second loan of 4.5 million U.S. dollars was granted for the completion of the two Tolima projects. Of the total of the two loans, 14.5 million U.S. dollars, 11.5 million were used for Coello and Saldaña, and 3.4 million for the Sisga project. The Sinbunday project in the remote Putumayo area was disregarded.

During the construction of the Coello and Saldaña irrigation projects, although they were well planned, numerous mistakes were made. One of the difficulties had its origin in a change of course of the Saldaña River in May 1954, approaching dangerously close to the main irrigation canal. At any moment the banks of the canal could have been swept away, and yet orders to rebuild the eroding banks were not given until the governor of the department himself had flown over the endangered area and had sent word to the central government, whereupon the necessary funds were provided.

At the suggestion of the Export-Import Bank an agreement had been signed

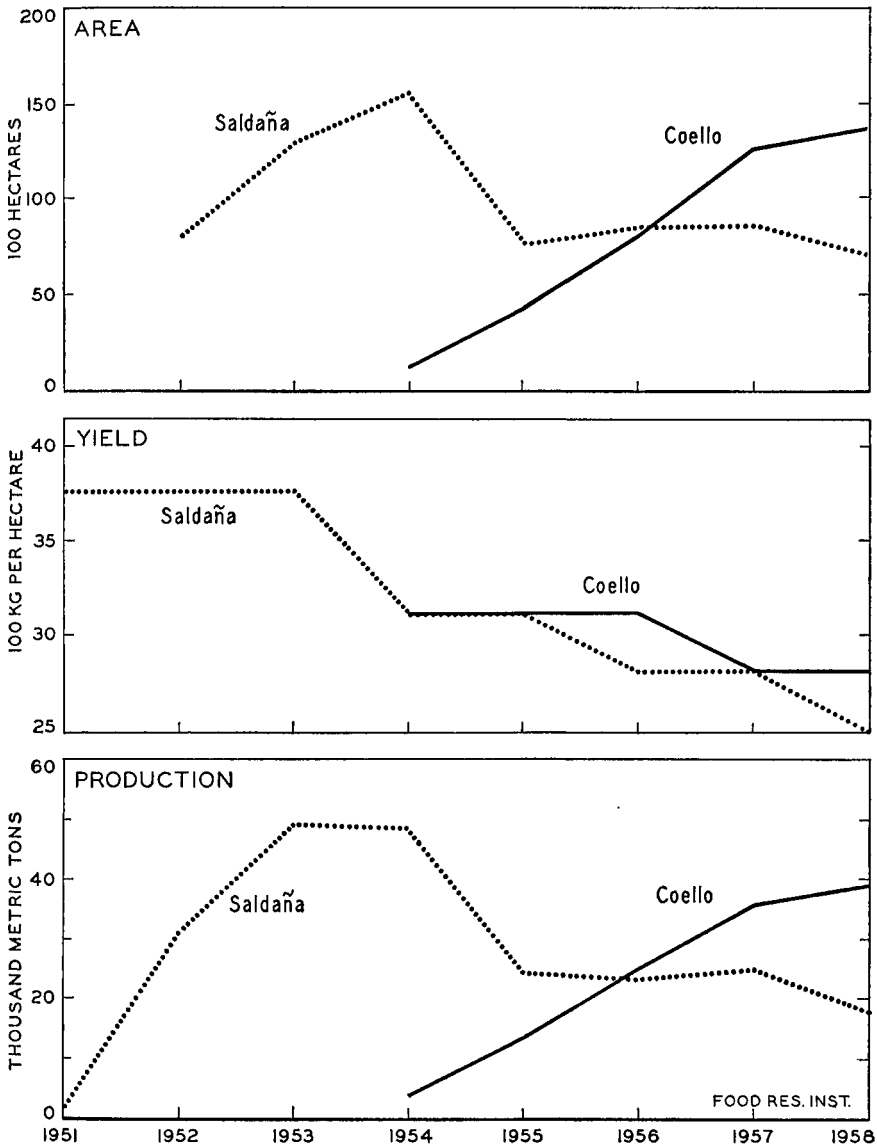
on November 22, 1947, naming the Agrarian Bank as the agency in charge of the Coello and Saldaña projects. Work began on the Saldaña project in June 1949 and was completed by May 1952. Actual costs greatly exceeded original estimates. The contract for construction was awarded to two American firms, which were to receive a fixed percentage of the total cost. However, no cost estimate was made. A well-known Colombian firm also placed a bid, proposing to execute the project for a fixed sum with guarantees, but its bid was rejected (94). Construction costs may thus have been increased considerably; in fact they are stated to have amounted to three times the fixed sum estimated by the Colombian firm. The contractors were not concerned, since in the end the landowners were the ones who would reimburse the costs.

Bureaucracy complicated matters excessively for the farmer. During the first year of operation the local representative of the Agrarian Bank had to apply for authorization from the central office in Bogotá for every single opening or closing of the sluices, and sometimes the authorizations took weeks. Since the price of water was low compared to the prices paid for rice, the farmers naturally chose to avoid difficulties by overflowing their land in order to assure themselves of a sufficient water supply, and the surplus they turned back to the river. This procedure was of course harmful to the soil. It also deprived other areas of urgently needed water, although the project provided enough water, properly used, for an area double the size. The excessive centralization of management almost led to collapse (94, p. 31). But procedures have since been modified. Technicians on the spot were granted more authority, and radio communication was established between the head of the Irrigation District and the Agrarian Bank in Bogotá. Since 1961 the water has no longer been paid for on the basis of acreage alone, but also on the basis of volume consumed (125, p. 10).

The irrigation project has never been used to anything like its full capacity. From 1954 to 1959 around 4,000 hectares were irrigated each half-year in Saldaña out of an irrigable total of 12,000; and in Coello, only 7,000 hectares were irrigated out of an irrigable total of 15,000. Even as late as 1963 not more than 50 per cent of the irrigable area was in fact being irrigated (39, p. 47). The foremost objective of most tenants was to make quick profits, the more so as rentals were high. Soils became exhausted; weeds and red rice spread rapidly. The technicians were deeply disturbed and blamed the existing system of land tenure. Absentee landowners were said to watch impassively the gradual depletion of their lands for the sake of high rentals. Tenants were accused of disregarding modern techniques of fertilizing and crop rotation (79, pp. 153-55). In 1954 about 7,000 hectares were cultivated in rice in the Saldaña area, half of which were not suited for this crop (24, p. 61); salty soil was sown to rice even though as early as 1943 soil surveys had revealed the existence of pockets of salty soil where poor drainage would destroy their agricultural value.

After two years of cultivation yields decreased substantially in both Coello and Saldaña (Chart 7). The rate of return per hectare to tenants fell, in current pesos, from 738.84 in 1953 to 342.57 in 1959. In constant pesos this is a drop from 4 to 1 within six years (36, p. 29). When the situation of the rice industry became critical, some producers shifted to cotton, and others migrated to newly developed areas.

CHART 7.—RICE AREA YIELD AND PRODUCTION IN THE COELLO AND SALDAÑA IRRIGATION DISTRICTS, 1951-58*



* Data from Colombia, Caja de Crédito Agrario, *Informe financiero, económico y social sobre el estado actual de los distritos de irrigación de Coello y Saldaña en el Tolima* (Bogotá, January 30, 1960), pp. 19, 21, 49, 50.

Despite these difficulties, the Coello and Saldaña irrigation projects were still worth while. By May 30, 1956, invested funds amounted to 31.9 million pesos (at the present value), corresponding roughly to the loans made available by foreign agencies. After 1959 expansion of the projects, new buildings and other improvements, increased the total by 4.8 million pesos. Another 2.9 million pesos have

been invested in machinery since 1954. In principle the fixed costs were to be borne by the owners. Since 1958, in fact, 800 pesos per hectare have been reimbursed by them, a total of 32 million pesos, which does not cover the total costs although they were calculated in devaluated pesos.

The government, which guaranteed the agreed rate of exchange, and the Agrarian Bank, which waited for years for partial reimbursement of the costs, bear the loss. Nevertheless, on the whole the Colombian economy has benefited from this project, and so have the landowners. As the following tabulation, in thousand 1959 pesos, shows, the gross value of production was in 1958/59 two and one-half times the pre-irrigation level in Coello and more than six times that level in Saldaña (36, pp. 26-27).

Gross value of production	Coello	Saldaña
1950	16,016	3,307
1958/59	40,321	21,806

Estimated annual rent was about 14 to 15 per cent of the value of output in Coello, 1 or 2 per cent higher in Saldaña. It is to be noted that 1958/59 was a year of uncommonly low inputs and correspondingly poor cultivation resulting in low yields per hectare.

It is customary in this area to calculate land rentals as a percentage of the gross value of production.³³ In Saldaña the rentals amount to 20 per cent of the rice harvest, 12 to 15 per cent of the cotton harvest. The rate is lower for cotton because this crop requires higher capital inputs on the part of the tenant. Returns to landowners rose along with the increase in productivity. In Saldaña where development started out from a lower level, land rents at the end of the 1950's averaged almost five times as high as 15 years earlier (in terms of pesos of constant purchasing power). In Coello, which had been more developed before the introduction of irrigation, the 1959 level was almost four times that of 1950. Once irrigated cotton was introduced in Saldaña an additional source of profit was created, which directly benefited landowners. Obviously, the profit was not made by the organizations bearing the costs. (See also Appendix Table VII.)

As shown by Table 13 the rice industry of Coello and Saldaña recovered well after 1959, when the output dipped to an eight-year low. Better technical assistance and improved marketing facilities played an important role in this recovery. Between 1959 and 1963 rice production in Tolima increased from 84 to 141 thousand tons, and two-thirds of this increase was produced in the Coello and Saldaña projects. This is due both to an increase in yields from 2,470 kilograms per hectare in 1960, 2,817 kilograms in 1961, 2,988 kilograms in 1962, to 3,241 kilograms in 1963, and to expansion of use of available irrigation water. At that time, the Rice Federation succeeded in obtaining the help of the Central Bank (Banco de la República) in financing the introduction of modern tools and methods of cultivation, as well as inducing the government to establish a more efficient system of price supports.

In order to promote diffusion of modern methods of cultivation, the Central

³³ The same system is used in Louisiana; there the customary percentage, 20 per cent for land use, 20 per cent for irrigation water, were higher than in Colombia where government water rates are low.

TABLE 13.—RICE PRODUCTION IN COELLO AND SALDAÑA COMPARED WITH TOTALS FOR TOLIMA AND COLOMBIA AS A WHOLE, 1946-65*
(Metric tons, rough basis)

Year	Colombia	Tolima	Coello and Saldaña		
			Total	Coello	Saldaña
1946	118,213	26,700	—	—	—
1947	149,614	37,082	—	—	—
1948	167,769	27,860	—	—	—
1949	207,641	52,239	—	—	—
1950	241,058	63,720	—	—	—
1951	296,805	58,000	1,522	—	1,522
1952	328,500	52,000	30,847	—	30,847
1953	272,045	62,000	48,712	—	48,712
1954	294,850	74,150	52,597	4,131	48,466
1955	320,200	86,000	37,469	13,300	24,169
1956	342,500	94,000	48,129	24,825	23,304
1957	350,200	94,000	60,374	35,752	24,622
1958	380,340	92,700	46,787	38,949	17,838
1959	422,000	84,000	25,700 ^a	15,700 ^a	10,000 ^a
1960	450,000	81,500	30,800	...	...
1961	473,600	98,600	45,600	...	...
1962	585,000	140,100	48,000	...	...
1963	550,000	141,000	62,800	...	...
1964	600,000	169,500	85,500	...	...
1965	672,000	156,500	...	...	...

* Unpublished data of the National Federation of Rice Growers except for Colombia 1946-59 from "Desarrollo del cultivo de arroz en Colombia," *Arroz*, Vol. IX, No. 105 (Bogotá, 1960); and for 1960-65 from "Aumento constante de la producción nacional de arroz," *ibid.*, Vol. XV, No. 165 (Bogotá, 1966); for Tolima 1946-60 from L. G. Correa O., *Como se cultiva el arroz en el Tolima* (Universidad Nacional de Colombia, Facultad de Agronomía, Medellín, 1952, thesis); for 1964 from National Federation of Rice Growers, *Informe de Gerencia, 1965*, p. 18; and for 1965 from source cited for Colombia. (For 1948 the figure specified by Correa as rough rice is given by Varela Martínez as milled rice.) For Coello and Saldaña 1951-58 from Instituto Colombiano de Reforma Agraria (INCORA), *Consideraciones sobre una política de irrigaciones en Colombia* (Consejo Social Agrario, Primer Reunión, April 17-22, 1962, Doc. 9, Bogotá).

^a Unpublished data of the Ministry of Agriculture.

Bank granted special credits to the banks which were to be used for the financing of the production of certain crops in specific areas. With rice, the farms cultivating between 5 and 60 hectares were to receive financial aid. Such credits were conditional on the use of selected seed distributed by the Federation of Rice Growers, the acceptance of supervision by its technical staff, and the use of weed-killers and other improved methods. This program concentrated mainly on the area of influence of the Federation, i.e., the departments of Huila and Tolima, and in particular on the irrigation districts. Data available for 1962 reveal an increase in yields of 35 per cent since 1959 (16). Also, the Federation began to engage in marketing because the storage capacity of the National Institute of Supply (INA) was completely exhausted. From the point of view of price support policy INA, even at the end of 1962, no longer had storage space for the surplus that was accumulating, and the Federation on the market, almost too successfully took its place as a price-support agency. In Huila and Tolima alone, where half of the members and four of the ten permanent stations of the Federation are located,

a genuine surplus problem existed after one year. As noted above, the Federation faced this problem by obtaining authorization to export 40 thousand tons of rice at a loss concealed by privileges for imports of cars. This project did not materialize, however, since in 1964 a very bad harvest in dryland crops (so bad that at one time rice sold for less than maize or potatoes) suddenly opened new markets for rice (15, p. 2).

The concentration of efforts by the Federation in a single major area has led to the position of prominence in rice cultivation held by Huila and Tolima. The question why the Federation developed in Tolima rather than in Valle where rice farms are larger, or in the north of the country where the bulk of the production was located when the price support was initiated, is certainly pertinent. Undoubtedly the strongest support for the Federation was found in those two departments, and they were most in need of modernization.

One of the considerations which induced rice growers of Tolima to improve their cultivation techniques was the lack of alternatives. In other irrigated areas, sugarcane and cotton were important alternative crops, and in the vicinity of industrial centers maize also competed with rice. But on the Ibagué plateau of Tolima, for instance, cotton, unlike rice, does not grow well, rust-free varieties of wheat are still to be introduced, and maize prices are very unstable. Hence, decreasing returns for rice meant decreasing land value and rentals. Landowners and mill owners had invested significant amounts of capital in irrigation, machines, and mills. Tenant farmers were free to move to other regions, without additional loss, but not so the landowners. This operated as a powerful incentive to seek out new improvements that would raise rice yields and quality and that would lower unit costs of production; thus protecting and even raising their personal incomes. After a period of high profits, prices of inputs increased; high land rents and such technical difficulties as invasion of weeds and red rice induced some farmers to seek new areas, which were made accessible by improved means of communication and the reestablishment of peace. This flow of technical knowledge into the frontier accounted for major developments once capital became available.

Penetrating of the Llanos

Since the early 1950's, improvement in the transportation system, as well as growing internal security, has opened many regions to expanding rice growing, among them the foothills of the Sierra in the César Valley of northern Magdalena department and the eastern Llanos, principally Meta and Caqueta.

The department of Meta is one of the "frontiers" of Colombia. It covers an area of nearly 9 million hectares of relatively flat land suitable for mechanization, and it is the largest single block of underexploited flat land among the several departments (90, pp. 805-08). In 1959, only 48,627 hectares were planted in seasonal crops. Land in farms in 1959 totaled over 3 million hectares, but of this some 2.8 million were in pasture and woodland, and more arable land was in fallow than under cultivation (34, p. 25). Rice and maize are the main crops in this area, rice apparently yielding roughly a fourth more per hectare than maize (34, p. 25). Since the beginning of this century rice has been a basic cash crop in the lowland Llanos, and it still is.

Until World War II, the main obstacles to development of the eastern plains

were poor communications and the prevalence of malaria and other tropical diseases. Nevertheless, as much as 12,500 tons of rice produced there were sold in Bogotá in 1940 (13, p. 21). The rice boom of 1947 had little impact eastward in this region; relatively high costs of transportation continued to act as a brake to development. But in 1948, irrigation was introduced in the Llanos by a Swedish engineer, and a year later by two other rice growers. They developed irrigation systems not along the river banks, where they would be subject to flooding, but in the open plains where conditions, particularly good natural drainage, were favorable for rice cultivation (78, p. 6).

During the Gomez dictatorship beginning in 1946, the political situation of the country had deteriorated noticeably, and the flow of immigration to the Meta, which escaped control of the dictatorship, decreased. Rice production in 1951 was estimated at only 11,210 tons. Only 250 hectares of rice were mechanized, 230 hectares irrigated. The 17 small mills serving the area had a total capacity of 2,497 kilograms per hour, a fortieth of the national total (64, p. 54). Despite the tense political situation, the low cost of land so close to the Bogotá market continued to attract some adventurous pioneers. The return on capital invested exceeded 40 per cent per year for cattle farming. Land used for rice cultivation was sold at 40 pesos per hectare as compared to one to two thousand pesos per hectare in the irrigated areas in the central part of the country (115, p. 154). Between 1948 and 1953, during Gomez' dictatorship, an opposition group of armed "liberals" controlled most of the Llanos. Because of the civil war, about a third of the 1952 crop was lost (18, p. 20). With the wave of reconciliation following Rojas Pinilla's seizure of power in 1953, farmers settled in increasing number in the cheap lands of Meta, particularly rice growers affected by lower yields, high rentals, and continuing violence in the central part of the country. In 1955, however, floods and poor communication caused considerable loss (18, p. 20). Yet the move to the frontier continued. In 1956, a total of 928 rice growers cultivating 479 farms and making very little use of machinery grew 22,300 hectares of rice obtaining yields of 1,375 kilograms of paddy per hectare (18, p. 20).

Many of the new farmers of the Llanos lacked both adequate implements and the necessary capital. Thus in the Puerto Lopez area in 1957 a thousand hectares were cultivated with the aid of only five tractors, two combines, one or two drilling machines, and not a single leveler. These farmers had established a system of exchange of their meager equipment (105, p. 34). Soil preparation was of course deficient, and harvests not properly timed.

Rice production in the Llanos was nevertheless thriving in 1957. Enormous enthusiasm had developed for this crop, revealed by the activity of distinguished people in rice growing, the attraction of trained personnel from other rice areas, the establishment of agencies selling agricultural machinery, the activity of mills in Villavicencio, and the frequent visits paid by rice buyers. Side by side with this gratifying development, however, considerable difficulties continued to hamper the industry. Distances between Villavicencio and the producing areas were great, imposing difficulties on the farmers particularly during the rainy season; trained personnel were still few in number and wages high; the shortness of summer made drying very difficult. Machinery and spare parts were very costly; and above all, great risk was involved in cultivating rice in a new environment (30, p. 3).

Small farmers as well as large entrepreneurs moved eastward. In 1957, the manager of the Federation of Rice Millers set an example. He bought a farm in the Llanos, applied fertilizer and Paz de Río slag, and harvested 62.4 bags of rice per hectare. In Tolima, he had been paying 22 to 23 per cent of the produce to the landowner, had been obliged to use more fertilizer, but obtained lower yields on land infected with red rice, pests and diseases, and weeds (105, p. 34). In the Llanos it was worth while to make improvements because the land was his own. The low price of land, and the proximity to a good market, Bogotá, justified expansion of irrigation. In 1958, as much as 3,000 hectares were to be irrigated in Chinchimene, 1,500 hectares in Surimena, and 500 hectares in Pachaquiario (3, p. 7).

Yet approximately 95 per cent of the land sown to rice was still cultivated by hand; mechanized cultivation was exceptional. Most farmers worked in partnership, the landowner paying wages in kind, thus avoiding payment of high wages for weeding and harvesting (88, p. 10). To reduce these expenses, technicians of the Federation of Rice Growers introduced herbicides and simple tools. Weeding costs fell to a tenth of what they had been before, from 180 to 18 pesos per hectare, and harvesting costs were cut by half, thanks to the introduction of simple machinery (9, p. 7). A rice agronomist was permanently appointed to this area in 1958. This was a bad year for rice growers, when the *hoja blanca* spread to Colombia. In 1959, farmers growing Bluebonnet and Rexoro suffered considerable losses, and on the advice of the Federation, 80 per cent of them changed to disease-resistant varieties of lower quality such as Canilla and Fortuna (70, pp. 18–19).

In 1960, irrigated rice grown in the plains was said to yield between 1,875 and 2,500 kilograms per hectare, and that grown on the fertile banks of the rivers, between 2,500 and 3,750 kilograms. The use of such fertilizers as Paz de Río slag and granulated fertilizer became increasingly popular (122, pp. 14–18). Even the many farmers who still cultivated by hand made increasing use of herbicides to avoid weeding by machete (78, p. 8).

In 1961, only 10 per cent of the rice output was grown on mechanized farms or under irrigation. On farms equipped with modern machinery rates of return were good—estimated at 33 per cent above cost, or 22.76 pesos per *carga* as compared to a meager 9.33 pesos per *carga* in Tolima (124, p. 18). By this time the large, modern farms were located near the roads and had good transportation to market.

Many producers, however, still farmed in remote areas, removed from civilization and vulnerable to floods and other natural catastrophes. In 1961, thousands of bags of rice piled up on account of the overflowing of the Ariari River. With no storage facilities available, they were in danger of spoiling (128, p. 6). About 100 thousand bags were abandoned on the banks of the river; buyers purchased the rice at prices up to 40 to 50 pesos per *carga* below the price of 118.70 pesos supported by INA. INA, however, did not establish a buying point in the area; at the same time, it was importing large quantities of American rice, e.g., 34,926 tons in one year! (59, p. 25).

Within the past few years a major obstacle to development of rice in Meta, few and bad roads, has gradually lessened. Improvements were made on the

Bogotá-Villavicencio road and the two trunk roads leading from Villavicencio eastward to Puerto Lopez and southward to the Ariari colony. Rice growing has developed considerably; production increased by 25,000 tons between 1954 and 1963. The mills diminished in number but rose greatly in capacity per hour; in 1962, 12 mills had a capacity of 14,600 kilograms per hour (104, p. 11). The proximity of the important Bogotá market and improved transport have created the financial incentive needed by the pioneers of the Eastern frontier. The rice industry has played and is still playing a vital role in regional development.

Northern Colombia

In northern Colombia, the rice market is dominated by the demand from the three major cities, Barranquilla, Cartagena, and Santa Marta. Barranquilla is by far the most important, and draws supplies both from east and from west of the Magdalena River. (See Map 5).

The producers' response to better prices and a growing market differed significantly between east and west. In the east, better communications with Valledupar following improvement of the road system, and colonization of the César Valley by cotton growers after 1950 brought experienced people, machinery, and capital into this formerly cattle country. People were soon to discover the favorable opportunities offered by rivers flowing from the Sierra Nevada and the Cordillera Oriental, the good drainage of the soil, the favorable climate (hot but not too humid), and the low price of land. Advantage was taken of the credit facilities offered to agriculture under Law 26 of 1959; recently, with such credits, new irrigation districts have been developed in Valledupar and Badillo.

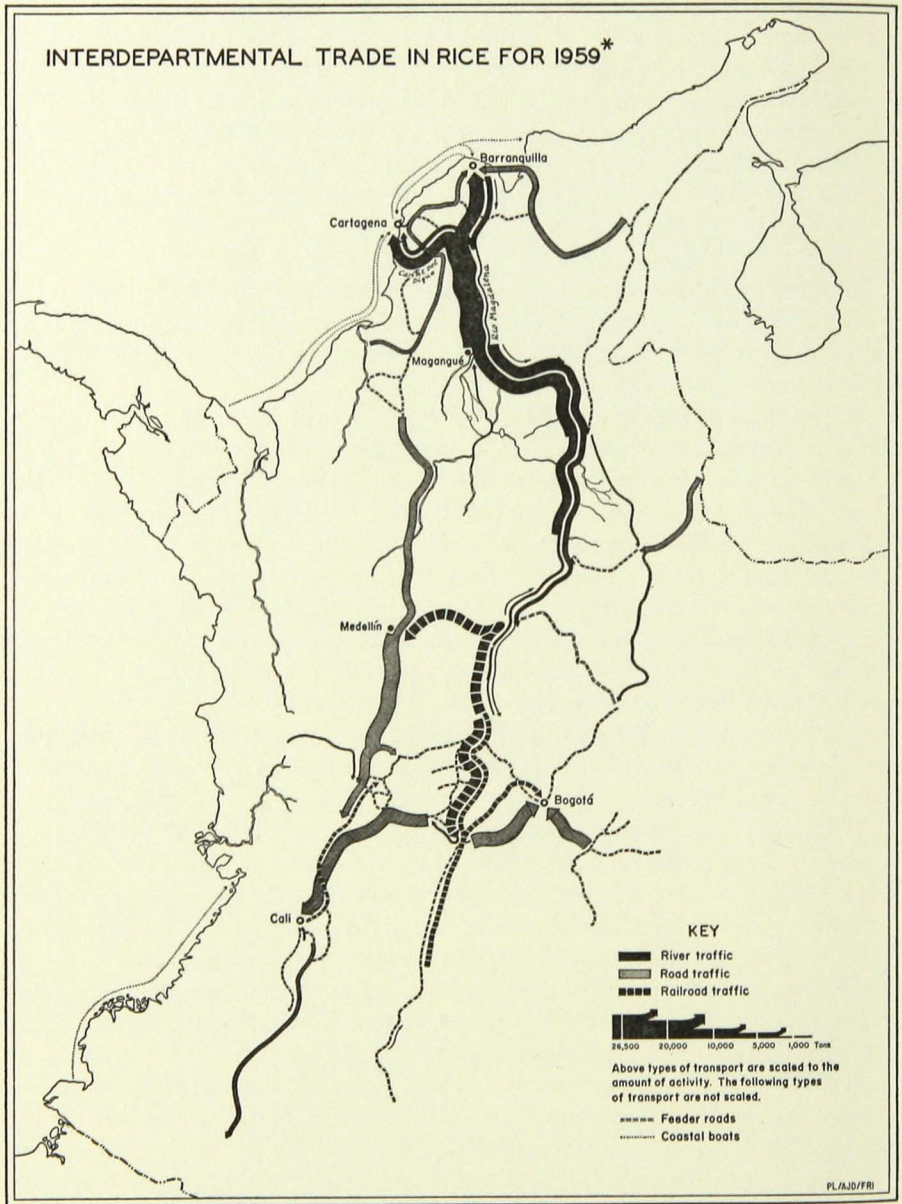
In 1963, irrigated districts produced 35,000 tons, nine-tenth of the total production of Magdalena department, which then became as important a producer as Bolívar or Córdoba.

The cost of production, particularly the labor cost, is high. This disadvantage is somewhat balanced by the assurance of obtaining good yields under controlled irrigation. Valledupar rice growers are likeliest to make a profit when their competitors for the Barranquilla market along the rivers west of the Magdalena are affected by plant diseases and frequent droughts or heavy floods that cut their production; but when the competitors have abundant harvests that bring low prices, the irrigating farmers of Valledupar have difficulty. Sometimes they resort to smuggling their rice into Venezuela.

Elsewhere in the north, commercial rice growing was introduced but was soon checked by both natural and economic conditions. In the banana belt, during World War II, shortage of shipping facilities drastically cut production and income levels, and irrigated areas shifted to rice. In 1948 the irrigation systems of Aracataca and the banana belt were the only ones in the department of Magdalena. At one time 3,000 hectares were cultivated under irrigation, but by 1955 only 800 hectares. Legal conflicts with the holder of the water rights, the Bananera de Sevilla, together with depletion of soils and the appearance of various pests and diseases, accounted for most of the downward trend (27, pp. 12-22). Upland rice was a success at the Caracolito colony on the foothills of Sierra Nevada.

West of Magdalena, irrigated rice growing has on the whole failed. In the

MAP 5



* The author's interpretations from transport data in Norman Gillmore, *La futura demanda de transporte de Carga en Colombia* (unpublished manuscript, Bogotá, August 1963), Table 3.

departments of Bolívar and Córdoba together, only 2,500 hectares of rice were irrigated in 1963. In the San Jorge Valley, Córdoba, by 1964, only two farms were known to produce upland rice with modern methods.⁸⁴ Rice disappeared from the central region of Córdoba, where the farming area above flood level shifted

⁸⁴ Interview with Raúl Haddad, Montería, May 9, 1964.

to cotton. Labor is too expensive to use hired hands in rice production, and mechanization proved to be impossible. The area is rainy, the soils heavy and damp; the dry season coincides with the stopover of swarms of small migrant birds from Canada; and the fertility of the soil encourages growth of weeds. Some farmers sought to produce irrigated rice under mechanization. One intended to cultivate 1,000 hectares per season, but had to give up after serious losses. The harvesting machinery was bogged down in mud, so that harvesting had to be by hand at a high cost. And the grain had to be dried mechanically, which spells additional cost (74, p. 234). In 1961, estimated costs of production for mechanized rice cultivation were as high as for hand grown rice (84).³⁵

Today, as in the 1920's, the bulk of the production of Bolívar, Córdoba, and southern Magdalena is grown in small plots, following two major cultivation systems well adapted to the local circumstances but hard to improve. There is swamp rice, mainly grown on the river banks, and there is upland rice grown in combination with maize. In 1955, upland rice in Magdalena was grown mostly by small farmers under very poor conditions. By most standards it was very unprofitable. Seeding and care of the crop was fairly inexpensive, but the harvesting, done by hand, increased costs of production enormously. Transportation of produce to the mill or market was a major problem; usually it was done by mule back. Prices were low and high interest had to be paid on loans for subsistence and seed provided in advance for the next crop (27). Nevertheless, upland rice, a typical pioneer crop grown in the wilderness on the most humid land, has expanded with improving communications.

West of the Magdalena River, natural conditions are such that rice cultivation is possible with primitive tools. No improvements were made, and in the course of time the competition of cotton growing on higher land and rising wages confined rice to the frontier areas, the river banks, and the plots of small peasants.

As mentioned previously, swamp rice (*forestero*) is grown on small farms on the banks of the Sinú River in northern Córdoba, along the Cauca, Necchi, and San Jorge rivers in southern Bolívar and southern Córdoba, and along the Atrato River in northern Chocó. After seedbeds are prepared, the rice is transplanted to the river banks, where it is flooded by and during the seasonal rise of the waters. It grows as the water level rises and is harvested once the rains have stopped. This kind of natural irrigation requires no investment, but it is subject to all the uncertainties of seasonal floods and also of land tenure problems resulting from shifts in the river beds and banks. Yields exceed 2,000 kilograms of paddy per hectare and weeding is the only considerable care necessary. Fields are small.³⁶ In southern Córdoba the situation is different. Rice fields extend to the edge of the virgin forest. Small farmers clear one or two hectares of land and plant the virgin soil with a combination of rice and maize. The same system is applied on the large cattle farms, where small farmers are given about two hectares of land covered with brush for a period of two years, under condition of returning it to pasture at the end of the second year.

³⁵ In 1963, a miller and rice grower spent .7 peso per kilo for harvesting rice that he could buy for his mill at 1 peso.

³⁶ For instance, in the Boca de Tinajones at the mouth of the Sinú about 1,200 families make a living from rice produced for the Cartagena market, and the average paddy field per family is only about one hectare (74, p. 235).

The above described systems use labor intensively. Seeding is dependent on the weather, and farmers cannot shift seeding time so as to avoid invasion of the migrant blackbirds from Canada which winter in Colombia from December to April. To expand production is difficult for lack of hands at harvest time. In 1952, for instance, in Acandí in Chocó, the wages paid for harvest amounted to a third of the total value of the harvest, and to 30 times the rental paid for land. Yields were high—3,900 kilograms of paddy per hectare—but with 80 per cent of the population engaged in rice growing, no workers were available (101, pp. 14-16). The high cost and seasonal shortage of labor caused a decrease in rice production in the Montería-Cerete area after the introduction of cotton.

All along the rivers, a single family rarely cultivates more than five hectares of land (121, p. 14). Primitive tools include the flail for threshing, a bad method because so large a percentage of the grains are broken, with the consequence of very low prices to producers (80, p. 5). Yields for upland rice depend heavily on weather conditions and availability of water. The harvest will be substantial with favorable weather, but a long and hot summer will not only reduce yields but will increase the risk of being attacked by such plagues as mice which may cause considerable damage, as in Bolívar in 1953 (17, p. 23). Wide fluctuations in production make for great price fluctuations. And small farmers living in remote areas and cultivating fields scattered over clearings and swamps have little access to credit, so that they are continuously indebted to salesmen and get only a relatively small part of the final value of their produce. In 1951, a year of very high prices, the total production costs of rice in Córdoba were estimated at 6.3 million pesos; the ex-mill value of white rice for that year was 13.4 million pesos (114, p. 41). Such figures offer an ample margin for producers' profits, transportation, milling, rate of interest, trade margin, etc. The trade margin is notoriously high, particularly if merchants have provided credit; thus in 1955, in the Sinú rice area the producer got 13 pesos in cash for a *botija* (30 kilograms) of rice, but only 4 pesos when he had received advance payments (17, p. 24). Rice was traded in boxes provided by the buyer of a volume not known precisely to the producer, a fact which, of course, works to the buyer's advantage. In the area of Carmen de Bolívar, margins of trade were estimated at 300 to 400 per cent in 1958 (62, p. 7). In southern Córdoba the margins are still high. In 1962, in upper Sinú Valley, petty traders bought rice in the producing areas at prices as low as .4 peso per kilo, and resold it to INA or to a miller in Montería at .7 peso per kilo (74, p. 135). In 1964, 25 pesos would have been paid in a remote village of Córdoba for a *carga* of rice that was sold at 58 pesos in Montería; but these 25 pesos are not given directly to the farmer but are deposited in an account which covers his daily purchases of commodities, and for these he is charged about double the normal price (truck system). Such difficulties have been partially solved by the credit policy of the Agrarian Bank, but administrative requirements and delays seriously hamper the access of peasants to stabilization and credit facilities.⁸⁷

The difficult position of the small growers, relatively isolated, badly informed, subject to local trade monopolies, with insufficient credit resources, is a cogent reason for the slow rate of growth of regional production.

⁸⁷ In an agency of Córdoba department in 1964, the small peasants queued up for 15 days merely to meet the manager of the local agency of the Agrarian Bank.

The overall picture for northern Colombia shows a significant shift, from the west to the east, of supply sources for Barranquilla and the two other major cities of Magdalena. Price support, availability of capital resources, and technical knowledge led to the development of a new rice belt in the César Valley. But in Bolívar, Córdoba, and the northern Chocó, the traditional suppliers of Barranquilla and Cartagena, expansion of production was slow. Although small farmers increased their output the share of Bolívar and Córdoba in national rice production decreased from 41 per cent in 1934 to 21 per cent in 1954 and to 14.5 per cent in 1963.

On the whole, rice production increased steadily because of the natural fertility of the soil and the rising number of rice growers. No modern methods of cultivation, such as selected seed, were introduced and no increase in returns to the farmer was to be observed. Despite excellent natural conditions, upland rice production in northwestern Colombia failed to keep pace with the general upward trend in the rest of the country.

Competition for Water in the Cauca Valley

The Cauca Valley was the first major irrigated rice center of Colombia. Notwithstanding the favorable size of rice farms there, the largest in Colombia (Table 9, above) introduction of modern techniques was considerably delayed, in contrast to what happened in Huila and Tolima. And with expansion of sugar and cotton production, the struggle for both land and water appreciably restrained rice expansion.

Complaints about the difficulties encountered as attempts were made to modernize rice growing in the Cauca Valley can be read in many reports of extension agents and agronomists. One factor blamed for its stagnation is the system of land tenure; it is alleged that high rentals⁸⁸ make it impossible to leave the land in fallow, thus cleaning the land, and since most farmers are tenants, improvements such as eradication of red rice, pests, and diseases do not pay (26, p. 11). It was nevertheless profitable to grow rice in the Cauca Valley, as shown by the following examples. In 1943, production costs amounted to 157.5 pesos per hectare; the yields were about 2,400 kilograms per hectare. One *hanega* (600 kilograms) of paddy sold for 70 pesos, so that the farmer had a gross income of 280 pesos per hectare and despite high rentals was still making a profit (95, p. 58). The situation was similar in 1952 when the profit of the owner-operator averaged more than two-thirds of the cost of production (111, p. 14). With such high profit margins prevailing, not much attention was paid to quality. Year after year rice was grown on the same fields.

Application of fertilizers did not pay in 1942 (134, p. 40). When in 1954 the Statistical Department of the Administration of Valle organized a survey of the farming practices of the rice farmers (58, p. 27), only 26 farmers out of a total of 298 used fertilizer. Most farmers planted seed sold by the local mills, mostly not disinfected. Milling losses were extraordinarily high; of 123 farmers who responded to them, 70 had milling losses exceeding 50 per cent, 49 around 50 per

⁸⁸ In 1943, land rentals (commonly in kind) amounted to 35 per cent of the gross value of the produce (96, p. 15). In 1964, they still amounted to one-third. In Tolima, however, they range from a fifth to a fourth.

cent, 3 around 40 per cent and only one around 30 per cent. This loss sprang mainly from the farmers' custom of selling the rice while it stood in the field, still moist and full of impurities. Two-thirds of the farmers sold in this way. In 1956, lack of progress in the industry was manifested by absence of crop rotation, use of poor varieties of rice, disregard for fertilizers, and abundance of weeds (109, p. 3). By 1964, the situation looked considerably better. Although in the southern part of the Cauca Valley rice growers persisted in the use of gravity-flow irrigation (117, p. 309), in Valle technical assistance by the Federation had contributed considerably to overcoming major obstacles to growth (118, p. 446). Difficulties inherent in the modification of well-established traditional patterns, and possibilities of shifting to more profitable lines of production and thus avoiding troubles connected with introducing advances in rice culture, weakened the relative position of rice growing for many years. The outcome of the competition for land with cotton, and especially sugarcane, was to move rice growing to new areas, away from the cotton belt, and away from the shadow of the large sugar mills.

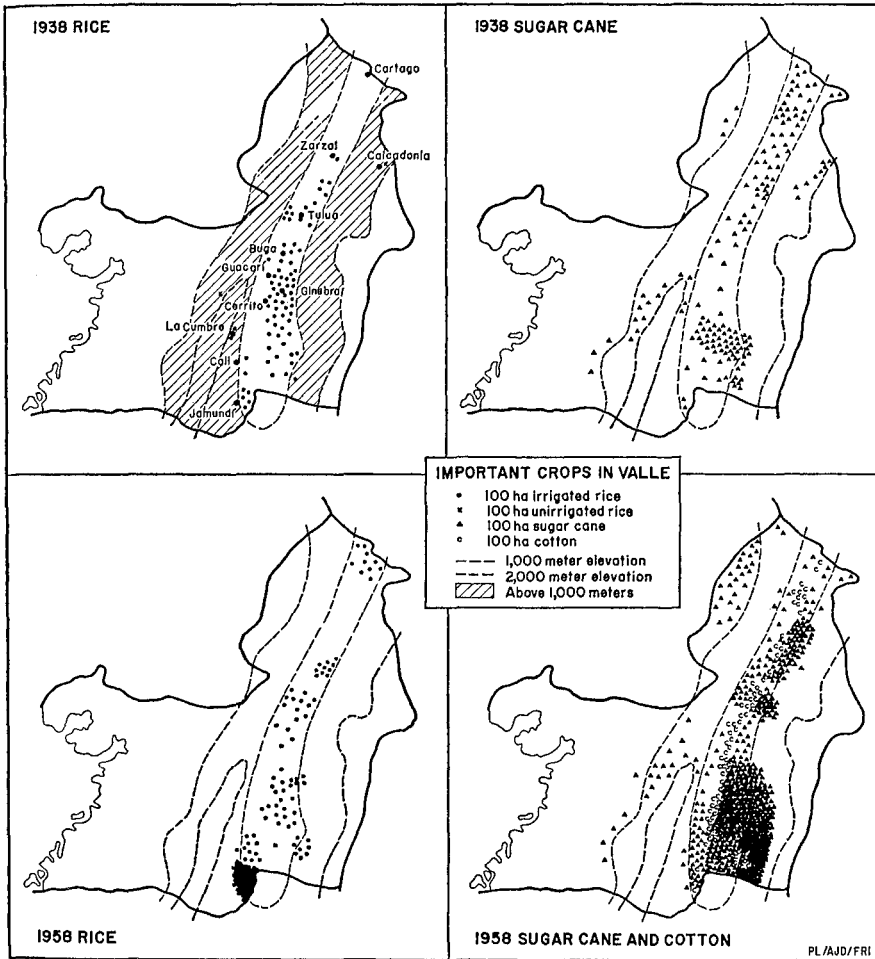
In 1938, the Statistical Bureau of Valle had made a census of the main crops and the areas cultivated according to municipality (48, p. 32), and in 1959, another census was carried out by the Faculty of Economics of the Universidad del Valle in Cali (29). Between these dates the total area under cultivation and pastures had increased 38 per cent from 844,243 to 1,167,947 hectares; the area in rice had doubled from 7,619 to 14,240 hectares. Available data reveal a substantial shift in the locational pattern of the rice industry (Map 6). Between 1938 and 1958 most of the expansion took place in Jamundí, south of Cali, some around Tulua, and some in the north, near Cartago. Upland rice disappeared from La Cumbre and Caicedonia. In the central part of Valle, in Buga, Guacarí, Ginebra, and Cerrito, a total of 1,500 hectares, a fifth of the total acreage in rice in 1938, was used for other crops.

One of the main reasons for this shift was competition for the use of water. In Guacarí and Ginebra, use is made of low-yielding rice varieties that grow well in colder and rapidly flowing waters. The expanding sugar industry, however, had the capital necessary to buy land endowed with water rights, and thus it came to monopolize available water supplies.⁸⁹ On the whole sugarcane competes with rice not so much for the use of land as for the use of water, and such competition has been a major cause of stagnation in the local rice industry. It is quite evident in Zarzal, where the Riopaila mill is located, and on the eastern shore of the Cauca River south of Buga, where all the other major Colombian sugar mills—Manuelita, Providencia, Central Castilla, are located; rice has shifted to Jamundí, where water is abundant, and where, in 1958, the influence of the sugar mills had not yet become important. Of the total acreage in rice in 1958, 40.2 per cent was to be found in Jamundí, as compared to 6.3 per cent in 1938.

Many new sugar mills were built on farms formerly growing rice, and sugarcane was planted; nearly a fifth of the area so taken over had been in rice before (92, pp. 38-39). Since most of these farms held water rights, sugarcane could be grown at once. At times the shift from rice to sugarcane was very sudden, a re-

⁸⁹ For instance, the Ingenio Providencia bought a total of 4,907 hectares of land between 1926 and 1959, of which 794 hectares were formerly sown to rice (112, p. 3).

MAP 6.—LOCATION OF RICE AND SUGAR CULTIVATION IN 1938 AND 1958, AND OF COTTON IN 1958 IN THE CAUCA VALLEY*



* Data for 1938 are from Colombia, Valle del Cauca, Dirección Departamental de Estadística, *Anuario estadístico del Valle del Cauca—1938* (Cali, 1940), p. 32; and for 1958 from Universidad del Valle, Facultad de Ciencias Económicas, *Censo agropecuario del Valle del Cauca—1959* (Cali, 1963).

sponse to change in price relationships. One rice grower, who had 1,152 hectares in irrigated rice, almost from one day to the next built a mill and planted the whole area in sugarcane. Then in 1954, irrigated cotton appeared as another competitor for land. This increased even further the pressure on inefficient land utilization; and by 1964 cotton itself was largely displaced by sugarcane.

Whereas the Valle sugar industry is relatively well organized and progressive, the rice industry has been considerably handicapped by slow elimination of traditional cultivation methods and absence of good seed well adapted to the environment. Seed selection has concentrated mainly on the varieties Bluebonnet 50 and Rexoro, which do rather poorly in most of Valle. An increasing portion of Valle's rice consumption has been provided by other departments—24,742 tons

in 1959 (75) and 32,800 tons in 1963.⁴⁰ The increased specialization is dramatized by the example of two sugar mills, Pajonales in Tolima and Manuelita in Palmira, Cauca Valley. Both have the same owners. Pajonales, the only sugar mill in Tolima, closed its doors and in 1960 the farm was used for multiplication of imported rice seed under close supervision. But meanwhile, Manuelita maintained its leadership among the largest sugar mills of Colombia.

In the Cauca Valley, a settled and quite modern agricultural area, constant shifts in land use have followed—as in any modern agriculture—the fluctuations in profit margins. In recent years, rice did not contribute significantly to the increase of regional wealth as it did in the middle Magdalena Valley, the Llanos, or the César Valley; emphasis fell much more on sugar than on rice. With so many other opportunities presenting themselves in the Cauca Valley, it was easier to pass from one supported commodity to another than to face technical difficulties in rice improvement. The rice producers of the Cauca Valley were followers and not initiators of progress in this industry, and the Rice Federation was less active there than in the middle Magdalena Valley.

In other departments rice is less important; indeed, a large part of the harvest is used locally for subsistence by the producers. All over the country the opening of new roads made colonization possible; settlers cut and burnt trees, planted rice and maize for their own consumption, and sold surpluses if and when they were available. The revolution in transportation brought about the major change in their activities. At present, a map showing the relation of upland rice relative to humid areas would more or less indicate the economic frontier of agriculture. The isolated irrigated region around Cúcuta in Norte de Santander shows conditions somewhat similar to those of the Cauca Valley; irrigated land is scarce and opportunities exist for growing sugarcane both for the production of noncentrifugal raw sugar (*panela*) and for the supply of a neighboring Venezuelan mill, and for dairy farming as well. Whole rice farms there are shifting to sugarcane.⁴¹ The department of Caqueta, located east of the Cordillera on the frontier, does not have easy access to the Bogotá market, which promotes the Meta economy, but rice growing is, nevertheless, developed there on cheap lands with similar methods. With the exception of the Cúcuta rice belt, these areas have developed as a result of better transportation and settlement, and are but vaguely related to specific policy measures.

CONCLUDING OBSERVATIONS

Since 1930, intervention of government in agricultural policy has increased, though sporadically and with varying success. The growth and progress of the rice industry are in marked contrast to the obvious stagnation of the other main grain crop, maize.

Achievements in the rice industry are due to an odd combination of government interventions and the initiative and talent for organization of a small group of rice growers facing a future of reduced profits. Before World War II, reinstatement of the custom tariffs and introduction of irrigation into Tolima de-

⁴⁰ Letter from Dr. Moraizan, May 5, 1964.

⁴¹ Interview with J. Atchortua, Cúcuta, May 3, 1964.

partment had given the first strong stimulus to production. After the war, high world prices and the closing of the borders to private imports caused a new rush to rice production. People from the cities as well as farmers grew paddy rice on rented or owned land at very high costs; irrigation projects were developed, machinery was bought, and mills were built. Then with the inflation of input prices production of rice became less attractive. Changes in policy sharply increased the cost of imports of fertilizers and other inputs. Plant diseases and pests, spreading of weeds, depletion of soils, and other troubles decreased yields, and smuggling reached alarming proportions.

In some areas, alternatives in land utilization existed, and shifts actually occurred, as for instance in Valle, in the banana belt, and in Central Córdoba. Had those shifts been possible all over the country, growth would eventually have resulted from the use of new lands and substantial changes in location; the application of modern technology, however, might well have been substantially delayed by the lack of pressure.

Such pressure developed in Huila and in Tolima as a result of the specific ecological conditions of the areas. No economic alternatives to rice growing existed there. The only other possibility would have been cattle fattening, which, however, was an unsatisfactory proposition on lands of such high value. Decreasing yields and profits induced some farmers to seek out other zones; the landowners, sometimes owners of rice mills, were most affected by the lower yields and the subsequent pressure on land values.

To improve profit margins and consequently land values, different lines of policy could have been followed. The rice growers and their federation could have tried to bring about a decrease in the price of the purchased inputs, fertilizers, seeds, insecticides and herbicides, and machinery. They might also have asked the government for higher support prices in order to offset the effect of lower yields. Or they could have stressed better credit facilities, and extension of the governmental support to the irrigation schemes, as a method of improving their lot. Finally, a most difficult but, in the long run, a most rewarding line of policy was possible, to try to offset lower yields and lower returns by substantial and continuous effort in the adaptation and diffusion of more modern methods and implements of production.

This cost-reducing policy was the one primarily and consistently emphasized by the Rice Federation, with its strongest and most active support amongst the paddy farmers of Tolima and Huila; under its continuous leadership, improvements in methods of cultivation have progressively restored the margins of profit of the rice growers, establishing a new basis for growth.

This choice of emphasis, however, was not completely free: the forces operating in Colombian politics precluded any important decrease in the price of purchased inputs. Such a decrease would have substantially affected the well-entrenched interests of the new national industries, which depend for their survival on a protected market at high price levels. Any increase in the price of rice, on the other hand, directly affects consumers in the big cities. Moreover, Colombia is self-sufficient in rice and any large increase in prices would delay the increase in consumption necessary to absorb the growing production.

Better credits, better financing for the irrigation projects, and a somewhat

more efficient procedure in price stabilization policy, were more attainable targets; and the building up of their association made it easier for the rice farmers to obtain that type of assistance. However, the most important contribution of the Federation has been in the technical field, and was due to its continuity of action which contrasts sharply with the frequent shifts in government personnel and policy. Thus in the early fifties, the supply of better seed was perceived as the most urgent problem of the industry. In 1964, the sorting plants of the Federation provided the farmers with seed equal to that imported from the United States. And the wider use of weedkillers, changes in the techniques of irrigation, and other technical improvements can be attributed to that steady line of action.

As soon as the political and economic conditions had improved, managers and skilled laborers who had developed their skills during this process of modernization scattered all over the country. Reestablishment of civil peace in the Llanos, and construction of new roads in northern Colombia, expanded government credit facilities for irrigation, brought about substantial increases in production, more so as irrigated rice is not subject to climatic hazards to such a degree as dry farming and, therefore, allows for higher investments at less risk. Successive stages of development have repeatedly created fears of surpluses. So far, however, these have never materialized because of continuing increase in the national demand.

Production of upland and unirrigated swamp rice by small farmers has decreased in relative importance since 1945, although it has increased in absolute terms with the increase in the number of growers and the opening of new roads. Small producers have thus far withstood the competition of irrigated rice; they sell only part of their harvest, under conditions improved by better transportation and also by better information; their product, of lower quality but cheaper, has an established market among the poor classes of the cities of the north coast. However, in this market irrigated rice from eastern Magdalena is already competing with the swamp rice of the Cauca, Sinú, and San Jorge flood plains when the harvest of swamp rice is a failure; and this type of competition can become increasingly severe if irrigated rice continues to expand.

Thus, in the savannas and piedmonts of Colombia, the rapid introduction of mechanization, irrigation, better seed, and the use of herbicides and fertilizers accompanied by shifts in location of production, account, together with the larger area under cultivation, for most of the growth of Colombian output. Modernization of the production system, developed and applied mainly in a few specialized areas, by itself has increased regional specialization.

The evolution of the Colombian rice industry, resulting as it did in substantial increases in output and productivity, is a noteworthy example of agricultural development in the tropics. The path toward modernization has not been straightforward or easy. Periods of rapid expansion with a rush to expand rice cultivation in the parched savannas were characterized by high levels of capital investment, an influx of innovators, and a rapid increase in implements and other inputs. In times of meager profits use of inputs has been economized and cost-reducing devices imported and adapted. It is a story of "leaps forward" and of periods of consolidation and each has contributed in its way to the emergence of a modern type of agriculture within a traditional environment.

CITATIONS

- 1 *Actas del Primer Congreso Nacional de Productores de Arroz* (Ibagué, 1949).
- 2 "Actividades varias de la Federación," *Arroz*, Vol. XI, No. 133, 1963.
- 3 "Análisis y comentarios," *Arroz*, Vol. VII, No. 78, 1958.
- 4 Hernando Marquez Arbelaez, *El crédito del Estado en la economía colombiana* (Instituto Nacional de Abastecimiento, Bogotá, 1949).
- 5 J. A. Franco Arias, *El crédito a través de la Caja de Crédito Agrario* (Bogotá, November 1961).
- 6 Gildardo Armel, "Un crisis," *Arroz*, Vol. I, No. 5, 1952.
- 7 Arrocería Central advertisement, a rice mill with branches in Medellín, Armero, Magangué, Montería and Bernigas, in *Revista Nacional de Agricultura*, No. 478, 1944.
- 8 *Arroz*, Vol. III, No. 36, 1955.
- 9 ———, Vol. V, No. 51, 1956.
- 10 ———, Vol. V, No. 59, 1957.
- 11 ———, Vol. VI, No. 78, 1958.
- 12 ———, Vol. IX, No. 102, 1960.
- 13 ———, Vol. X, No. 118, 1961.
- 14 ———, Vol. XI, No. 122, 1962.
- 15 ———, Vol. XIII, No. 141, 1964.
- 16 "Arroz—datos numéricos—1963," in *Informe acerca de la ampliación del programa de agrocrédito solicitada por la Federación Nacional de Arroceros*. A confidential report in the Oficina de Planeamiento, Coordinación y Evaluación, Ministerio de Agricultura (Bogotá, 1963).
- 17 "El arroz en los departamentos de la Costa," *Arroz*, Vol. IV, No. 38, 1955.
- 18 "El arroz en los Llanos Orientales," *Arroz*, Vol. V, No. 51, 1956.
- 19 El arroz, nueva fuente de divisas—*Informe del gerente al 5º Congreso Nacional de Arroceros, Girardot, 1953* (Bogotá, 1953).
- 20 T. E. Nieto Arteta, *Análisis del crédito agrario en Colombia* (Universidad Nacional de Colombia, Facultad de Agronomía, Medellín, 1952), thesis.
- 21 "A la Asamblea Regional de Arroceros del Tolima rindió interesante informe el Gerente de Fedearroz," *Arroz*, Vol. XI, No. 122, 1962.
- 22 "Balance favorable: 900 millones vale toda la producción arrocería," *El Tiempo*, December 19, 1964.
- 23 Gustavo Berenguer, "Orientaciones agrícolas; nuevos rumbos de Granja Experimental de Armero," *Revista Nacional de Agricultura*, No. 493, November–December 1945.
- 24 Daniel Mesa Bernal, "Carta del presidente de la ACIA a la Sociedad de Agricultores de Colombia," *Agricultura Tropical*, Vol. X, No. 7, 1954.
- 25 Bonifacio Bernardes, Técnico del Brasil, "Informe para la Federación Nacional de Arroceros de Colombia," in *Informe anual del Gerente al III Congreso Nacional de Arroceros 1951* (Bogotá, 1951).
- 26 Luís María Cajiao, *Anotaciones sobre la industria arrocería del Valle del Cauca* (Universidad Nacional de Colombia, Facultad de Agronomía, Palmira, 1952), thesis.
- 27 J. G. Cala, "Realidades y perspectivas del cultivo del arroz en el Departamento del Magdalena," *Arroz*, Vol. IV, No. 39–40, 1955.
- 28 J. M. de la Calle, "Resoluciones del Banco de la República," *Revista Nacional de Agricultura*, No. 676, August 1961.
- 29 *Censo agropecuario del Valle del Cauca—1959* (Universidad del Valle, Facultad de Ciencias Económicas, Cali, 1963).
- 30 Roberto Charry G., "La industria arrocería en los Llanos Orientales," *Arroz*, Vol. VI, No. 67, 1957.
- 31 "Circular a los productores de la Costa Atlántica," June 4, 1949; quoted in Hernando Márquez Arbeláez, *El crédito del Estado en la economía colombiana* (Bogotá, 1949).
- 32 J. A. Cock, "Irrigación," *Revista Nacional de Agricultura*, No. 529, 1949.

33 Colombia, Departamento Administrativo Nacional de Estadística (DANE), *Censo 1960* (Bogotá), unpublished.

34 ———, *Directorio nacional de explotaciones agropecuarias (censo agropecuario), 1960—resumen nacional* (Segunda parte) (Bogotá, 1964).

35 ———, Caja de Crédito Agrario, Industrial y Minero, *Informe anual* (Bogotá, 1958).

36 ———, *Informe financiero, económico y social sobre el estado de los distritos de irrigación de Coello y Saldaña en el Tolima* (Bogotá, 1960).

37 ———, *Informe de Gerencia 1955-1956* (Bogotá, 1956).

38 ———, *Informe de Gerencia 31 de diciembre de 1962* (Bogotá, 1963).

39 ———, *Informe de Gerencia 31 de diciembre de 1963* (Bogotá, 1964).

40 ———, Instituto Nacional de Abastecimientos, *Informe 1951* (Bogotá, 1952).

41 ———, *Informe de Gerencia 31 de diciembre de 1961* (Bogotá, 1962).

42 ———, *Informe presentado por el Gerente del INA al Sr. Ministro de Agricultura* (Bogotá, 1963).

43 ———, *Informe presentado a los Ministros de la Junta Directiva del INA por el Gerente* (Bogotá, 1959), unpublished mimeo.

44 ———, unpublished data, May 1964.

45 ———, Ministerio de Agricultura, *Memoria del Ministro de Agricultura al Congreso Nacional de 1961—Parte general* (Bogotá, 1962).

46 ———, *Memoria del Ministerio de Agricultura al Congreso Nacional—1962* (Bogotá, 1963).

46a ———, Ministerio de Agricultura y Comercio, *Memoria del Ministerio Agricultura y Comercio al Congreso Nacional en sus sesiones ordinarias de 1934*, Tomo III (Bogotá, 1934).

47 ———, Ministerio de la Economía Nacional, *Memoria del Ministerio de la Economía Nacional al Congreso de 1947* (Bogotá, 1948).

47a ———, *Memoria del Ministerio de la Economía Nacional al Congreso de 1937* (Bogotá, 1938).

48 ———, Valle del Cauca, Dirección Departamental de Estadística, *Anuario estadístico del Valle del Cauca—1938* (Cali, 1940).

49 "El Comité de Arroceros de Huila se dirige a los agricultores del Departamento," *Arroz*, Vol. II, No. 8, 1952.

50 "Con un programa definido actúa hoy la Federación—Informe del gerente C. Boshell Manrique al 7º Congreso Nacional de Arroceros, 1958," *Arroz*, Vol. VI, No. 72, 1958.

51 "VI Congreso Agrario Nacional," *Revista Nacional de Agricultura*, No. 557, September, 1951.

52 "El Congreso Nacional Agrario y la Sociedad de Agricultores solicitan régimen preferencial para las exportaciones menores," *Arroz*, Vol. XI, No. 128, 1962.

53 Congreso Nacional de Arroceros, "Debe ser libre de impuestos aduaneros la importación de semilla de arroz," *Arroz*, Vol. I, No. 2, 1952.

54 "Documentos del IV Congreso Nacional de Molineros de Arroz" (Asociación Nacional de Molineros, Bogotá, 1961), unpublished mimeo.

55 "Contrabando de arroz," *Arroz*, Vol. XI, No. 122, 1962.

56 L.G. Correa O., *Como se cultiva el arroz en el Tolima* (Universidad Nacional de Colombia, Facultad de Agronomía, Medellín, 1952), thesis.

57 Adolfo Cuéllar, "Producción y comercio de arroz en Colombia," *Arroz*, Vol. IV, No. 41, 1955.

58 "El cultivo del arroz en el Valle," *Arroz*, Vol. V, No. 55, 1956.

59 "Declaraciones de la Asociación Nacional de Molineros de Arroz," *Arroz*, Vol. X, No. 113, 1961.

60 "Decretos del Gobierno Nacional—Cuota de fomento arroceros," *Revista del Banco de la República*, Vol. XXXVII, No. 441, July 1964.

61 J. N. Efferson, "The Production and Marketing of Rice," *The Rice Journal*, New Orleans, 1952.

62 "Factores que afectan la economía arrocera de la región del Carmen de Bolívar," *Arroz*, Vol. VII, No. 78, 1958.

63 "La Federación Nacional de Arroceros celebró nuevo contrato con el gobierno," *Arroz*, Vol. IX, No. 104, 1960.

64 Federación Nacional de Arroceros, "Distribución de la producción de arroz en Colombia en 1950," *Informe del Gerente al III Congreso Nacional de Arroceros, 1951* (Bogotá, 1952).

65 ———, "El arroz, nueva fuente de divisas," *Informe del Gerente al V Congreso Nacional de Arroceros, 1953* (Bogotá, 1953).

66 ———, *Primer censo nacional de trilladoras de arroz* (Bogotá, 1954).

67 Federación Nacional de Comerciantes, *El comercio colombiano en la economía nacional, 1951-1952* (Bogotá, 1954).

68 ———, *Que pasa con el arroz* (Montería, 1949).

69 ———, (Montería, 1947).

70 "La Federación no ha abandonado un solo frente, dice el Gerente, Dr. Juan Pablo Henao, en su Informe al Congreso Arrocero," *Arroz*, Vol. IX, No. 103, 1960.

71 Eduardo Fernandez, "Reseña sobre el cultivo del arroz en la zona de Armero," *Arroz*, Vol. X, No. 113, 1961.

72 Food and Agriculture Organization of the United Nations (FAO), *The Comparative Costs of Imported and Domestic Rice in Importing Countries*. Consultative Sub-Committee on the Economic Aspects of Rice, 7th Session, Item VIII(b) of the provisional agenda, October 20, 1962.

73 Emilio Fortoul, "Los suelos, el riego y los abonos en el Saldaña y otras regiones," *Agricultural Tropical*, Vol. XI, No. 3, March 1955.

74 Fundación para el Progreso de Colombia, *Estudio agro-económico preliminar del Valle Aluvial del Río Sinu* (Bogotá, 1962).

75 Norman Gilmore, *La futura demanda de transporte de carga en Colombia* (Bogotá, 1963), unpublished manuscript.

76 Octavio Londoño Gaviria, *Generalidades, proyectos y conclusiones agrícolas, económicas y sociales de la irrigación del Río Coello* (Universidad Nacional de Colombia, Facultad de Agronomía, Palmira, 1952), thesis.

77 Enrique Llano Gomez and Pedro Nel Pulgarin, agronomists, *Report*, cited by Raúl Varela Martínez in *Arroz* (Ministerio de Agricultura, Bogotá, 1949).

78 Alberto Gonzalez C., "Arroz en la Intendencia del Meta," *Arroz*, Vol. VII, No. 81, 1958.

79 H. Gutierrez, *Consideraciones técnicas y económicas de los proyectos de irrigación de tierras* (Universidad Nacional de Antioquia, Facultad de Agronomía, Medellín, 1952), thesis.

80 J. P. Henao, "La producción de arroz en Bolívar y Córdoba," *Arroz*, Vol. V, No. 56, 1956.

81 "Historia del cultivo del arroz en Colombia," *Arroz*, Vol. X, No. 118, 1961.

82 "Importantes conceptos sobre la industria arrocera nacional," *Revista Nacional de Agricultura*, No. 533, September 1949.

83 "Informe del Gerente de la Federación Nacional de Arroceros al VI Congreso del Gremio," *Arroz*, Vol. IV, No. 39-40, 1955.

84 *Informe del jefe de la Zona Agropecuaria de Bolívar* (Folder, Oficina de Planeamiento, Coordinación y Evaluación, Ministerio de Agricultura, Bogotá, 1961), typed report.

85 Mario Irraguerito, open letter to the Minister of Agriculture, Barco Vargas, published in *El Tiempo* around June-July 1964.

86 B. Vitaliano Izquierdo, *El cultivo del arroz en el Valle del Cauca* (Cali, Instituto Vallecaucano de Estadística, 1954); cited in *Arroz*, Vol. V, No. 55, 1956.

87 Nicolás Jurado B., *Causas de decadencia en la producción agrícola de la zona fría del Departamento de Nariño y posibilidades de contrarrestarlas* (Universidad Nacional de Colombia, Facultad de Agronomía, Medellín, 1952), thesis.

88 Alfonso Ospina Leon, "El Cultivo del arroz de secano en los Llanos," *Arroz*, Vol. VII, No. 80, 1958.

89 L. Lorinez, *Plan quinquenal de organización del mercadeo de productos agrícolas básicos en Colombia*, 2nd edition (Colombia, Instituto Nacional de Abastecimientos, Bogotá, 1960).

90 Alberto Lozano R., "Necesidades de maquinaria agrícola," *Revista del Banco de la República*, Vol. XXII, No. 381, July 1959.

91 G. P. Lozano, "Reseña histórica del arroz en el Tolima," *Arroz*, Vol. XI, No. 132, 1963.

92 Simeone Mancini, *Tenencia y uso de la tierra por la industria azucarera del Valle del Cauca* (Universidad Nacional de Colombia, Facultad de Agronomía del Valle, Palmira, 1953), thesis.

93 Carlos Boshell Manrique, *Hacienda el Saldaña, Domingo Rivera en Espinal*, cited in Caja Agraria, Industrial y Minera, *Informe financiero, económico y social sobre el estado actual de los distritos de irrigación de Coello y Saldaña en el Tolima* (Bogotá, 1960).

94 Carlos Boshell Manrique, "Memoria relativa a los desarrollos de irrigación en la Hoya del Río Saldaña en el Tolima," *Revista Nacional de Agricultura*, No. 593, 1954.

95 Elfren Cabal Martinez, "Alternativas en el cultivo del arroz, Colombia," *Revista de la Contraloría General de la República* (Bogotá), Vol. I, No. 8-9, August-September 1944.

96 Raúl Varela Martinez, "El agua y la agricultura en el Valle del Cauca," *Revista Nacional de Agricultura*, No. 487, 1945.

97 ———, *Arroz* (Ministerio de Agricultura, División de Economía Rural, Bogotá, 1949), unpublished mimeo.

98 S. P. McCasland, *Anteproyecto—irrigación Río Coello (Espinal)* (Bogotá, 1945).

99 José Ruiz Mesa, *Panorama de la industria ganadera del departamento del Magdalena en el año 1951 y su desarrollo a través de los organismos cooperativos de fomento* (Universidad Nacional de Colombia, Facultad de Agronomía, Medellín, 1952), thesis.

100 J. M. Izasa Misas, "Función del crédito agrario," *Agricultura Tropical*, Vol. IV, No. 1, January 15, 1948.

101 L. J. Moreno P., *Departamento del Chocó—sector agropecuario del norte, Acandí* (Universidad Nacional de Colombia, Facultad de Agronomía, Medellín, 1952), thesis.

102 "Nuevas semillas de arroz se entregan a agricultores," *El Tiempo*, December 7, 1963.

103 Nestor Obando, "Standardización de productos agrícolas," *Agricultura Tropical*, Vol. V, No. 5, May 1949.

104 Hernando Ospina, "Nuevas industrias colombianas—estudio económico sobre la extracción de aceite con base en la harina de pulimento de arroz," *Arroz*, Vol. XI, No. 121, 1962.

105 Miguel Parga Pantoja, "El arroz en los Llanos Orientales," *Arroz*, Vol. VII, No. 79, 1958.

106 Parsons, Brincherhoff, Quade, and Douglas, *Estudio del transporte nacional—plan de mejoramiento para los transportes nacionales* (Colombia, Ministerio de Obras Públicas, Bogotá, 1962).

107 Enrique de Rojas Peña, "Desarrollo de la producción arrocería del país," *Arroz*, Vol. VIII, No. 93, 1959.

108 ———, "El combate del arroz rojo con hormonas en los terrenos infestados," *Agricultura Tropical*, Vol. XI, No. 11, November 1955.

109 ———, "Trabajos agronómicos en el Valle," *Arroz*, Vol. V, No. 55, 1956.

110 Rafael Gomez Picón, *Magdalena, río de Colombia* (Bogotá, 1948).

111 Ramón Murgueitio Posso, *Aspectos sobre el cultivo del arroz* (Universidad Nacional de Colombia, Facultad de Agronomía del Valle, Palmira, 1952), thesis.

112 Ingenio Providencia S. A., *A los asistentes al segundo Congreso Nacional de Ingenieros Agrónomos y la Feria Exposición Agropecuaria y Fiesta de la Agricultura de Palmira, Noviembre de 1959* (Palmira, processed).

113 Jesús Atehortua Ramirez, *Historia de la industria arrocera en el departamento de Norte de Santander* (Universidad Nacional de Colombia, Facultad de Agronomía, Medellín, 1952), thesis.

114 Libardo Escobar Ramos, *El cultivo del arroz en el departamento del Córdoba* (Universidad Nacional de Colombia, Facultad de Agronomía, Medellín, 1952), thesis.

115 "La realidad agropecuaria del Llano," *Arroz*, Vol. I, No. 5, 1952.

116 "Realidades y perspectivas de la irrigación en el Huila," *Arroz*, Vol. VIII, No. 84, 1959.

117 "Reseña semestral del Departamento del Cauca," *Revista del Banco de la República*, Vol. XXXVII, No. 437, March 1964.

118 "Reseña semestral del Departamento del Valle del Cauca," *Revista del Banco de la República*, Vol. XXXVII, No. 438, April 1964.

119 Restrepo Echevarría, *Excursión en el Territorio de San Martín* (Bogotá, 1869).

120 *Revista del Banco de la República*, Vol. XXXVII, No. 439, May 1964.

121 M. B. Revollo, "A pesar del empirismo en los cultivos del arroz, Bolívar es uno de los mas grandes productores del país," *Arroz*, Vol. IV, No. 41, 1955.

122 Alfonso Samper U., B. A. Madero, R. de los Rios, R. Corrado, "Levantamiento agrológico de los Llanos Orientales," *Revista Nacional de Agricultura*, No. 658, 1960.

123 Alfonso Vergara Samudio, *Mercadeo del arroz en Bogotá* (Universidad de los Andes, Centro de Estudios sobre Desarrollo Económico, Monograph No. 1, Bogotá, 1959), mimeo.

124 Jorge Arana Sanchez, *Márgenes de comercialización y algunos aspectos del mercado de arroz, maíz, fríjol, trigo y papa* (Instituto Nacional de Abastecimientos, Bogotá, 1961).

125 "Se modifican las tarifas de riego en los Distritos de Saldaña y Coello," *Arroz*, Vol. IX, No. 110, 1961.

126 Servicio Nacional de Aprendizaje, *Estudio socio-económico, area de Nariño* (Bogotá, 1962).

127 Samuel Shima, "La Sociedad de Agricultores Japoneses en Colombia 1953-1954," *El Mercado Agrícola*, Special Issue, No. 77, 1954.

128 "El siglo, Bogotá," editorial of July 16, 1961, as quoted in *Arroz*, Vol. X, No. 114, 1961.

129 "Síntesis de modalidades de crédito de la Caja," *Carta Agraria*, Annex (Caja de Crédito Agrario), No. 116, July 1963.

130 "La situación arrocera en el Huila," *El Mercado Agrícola*, Vol. 30, 1953.

131 "El Superintendente de la Federación de Arroceros, Dr. Henao, habla sobre las posibilidades de la nueva financiación," *Arroz*, Vol. VI, No. 72, 1958.

132 Hernando Polanio Trujillo, "Bosquejo agrícola del Huila," *Agricultura Tropical*, Vol. X, No. 5, May 1954.

133 Jorge Ramirez Vasquez, *La hoja geográfica del Río Lebrija y sus posibilidades como zona de colonización en Santander* (Universidad Nacional de Colombia, Facultad de Agronomía, Medellín, 1952).

134 Nestor Vasquez, *El cultivo del arroz en el Valle del Cauca* (Escuela Superior de Agricultura Tropical, Cali, 1942), thesis.

135 J. R. Vejarano, "Datos históricos sobre el cultivo del arroz en Colombia," *Revista Nacional de Agricultura*, No. 459, September 1942.

136 Adolfo Ramirez Victoria, *Colonización agrícola en Caracolicito, Magdalena 1943-1948* (Universidad Nacional de Colombia, Facultad de Agronomía del Valle, Palmira, 1952), thesis.

137 Javier Pulgar Vidal, *El arroz en Colombia* (Federación Nacional de Arroceros, Bogotá, 1956), unpublished manuscript.

APPENDIX I

COLOMBIAN RICE STATISTICS

The stage of economic development of many a country might be appraised roughly by the quality of its statistical information. In any country, the best economic data are usually available in the more developed sectors of its economy and the continuous improvement of the accuracy of the data on a specific industry is evidence of modernization and progress.

This applies to the rice industry of Colombia. It is only since August 1964 that reliable monthly information on rice processed in all the mills of Colombia could be gathered, a result of the establishment of a special levy per kilo of rice entering the mills, to finance the activities of the National Federation of Rice Growers (60). Such a step toward accurate agricultural data is still to be accomplished for most other major Colombian agricultural commodities.

The statistics on the agricultural sector in Colombia suffer from serious lack of continuity and comparability. Law 131 of 1932 created the Statistical Office of the Ministry of Agriculture; in 1934, this office published a first statistical survey in some detail, applying to the year 1932 (46a). A second survey for the year 1934 was published in 1937 (47a). But law 82 of 1935 transferred all responsibility for compilation of statistics to the Controller General of the Republic, and this agency unfortunately was not interested in agricultural statistics. A resolution of the National Council of Statistics, dated October 25, 1944, removed from consideration a resumption of work on the preparation of agricultural statistics. The resolution reads as follows: "The Council abstains from considering the preparation of agricultural statistics until such means are available that would allow a reliable and scientific preparation of such statistics, for the Council is of the opinion that the absence of an agricultural census renders impossible the annual investigation of such an important source of wealth as this."

Reestablished in 1948, the Division of Rural Economy of the Ministry of Agriculture relied heavily on data given by agronomists in the field and by trade organizations, and on transport statistics, in an effort to give a picture of national agricultural development (97). Campaigns to promote the production of a certain product, or agronomists who spent more than merely a few hectic months in one area, provided better information, at least for certain areas. So also did data on products processed, such as rice going to the mills, barley going to breweries, and cotton to gins. Departments at a relatively high level of development, such as Valle and Tolima, prepared censuses of their own which were rather reliable; others, however, based their statistics mainly on guesses and assumptions. In Magdalena, for instance, even in 1954, "estimates" of production, except for cotton and cattle, were still unreliable. Indeed, it was not even possible to determine the quantities of coffee produced; too much was smuggled into Venezuela.

Fortunately, somewhat more detailed data on rice are available. During the Santos administration (1938-42), visits to rice fields and classification of seed were organized in the setting of the "rice campaigns," and, as a side effect, a better general knowledge of the characteristics and levels of production of the major rice growing regions resulted. Local committees of the National Federa-

tion of Rice Growers, first established in Tolima and then in Huila, Valle, and other areas, provided improved data after 1947. From November 1953 to February 1954, the Federation jointly with the Department of Economic Studies of the Central Bank formed two commissions of two investigators each, who visited all Colombian rice mills collecting data on rice milled in 1952 and 1953 with regard to such criteria as origin of the rice, varieties used, quantities sold as seed (66). This was the basis for compilation of more detailed statistics in major areas by the Federation of Rice Growers, showing acreage yields, and production of irrigated and of unirrigated rice. The agronomists of the Federation prepared an individual sheet of information for each farmer member of the association, and therefore a new useful source was supplied for the areas under consideration, mainly Tolima, Huila, Valle, Meta and Norte de Santander.

Although the best available, those data still have major flaws. Their coverage is presumably incomplete, more so in the earlier than later years. The production estimates, based on mill reports, are much better than the estimates of rice areas and yields per hectare; indeed, there is good reason to believe that even within the last decade, the rice acreage figures of some of the most important departments have been derived by dividing the more trusted estimates of production by what were believed to be fairly representative average or normal yields of the various districts concerned (e.g., see Chart 7, p. 275, for Coello and Saldaña, which shows maintenance of precisely the same yield estimates over several successive years, then new unchanging yield figures for the next few years).

Again, upland rice production is not mentioned in some departments where upland rice is known to exist, or else the quantity produced is underestimated.¹ It is therefore not surprising that large irreconcilable discrepancies exist between the rice estimates issued by different organizations, the discrepancies sometimes reaching 200 to 300 per cent for certain departments, including some important ones.² For Colombia as a whole there is much less discrepancy, primarily because milling and export data are more useful in checking and adjusting national production figures, and secondly because errors in estimates for individual departments partly offset each other when combined in national totals.

¹ Rice statistics published by the Federation of Rice Growers do not include figures for upland rice in Huila and Valle; nevertheless the *Boletín de Información Agropecuaria*, published by the Agrarian Bank gives information on upland rice for Huila.

² For 1963, on the basis of quantities milled and per capita consumption, the Federation of Rice Growers estimated rough rice production in the department of Córdoba at 39,000 tons produced on 1,500 hectares of irrigated and 24,500 hectares of unirrigated land. For the same year, another estimate, published by the *Banco de la República*, stated 71,000 hectares producing 106,000 tons. This estimate, however, does not take into account the losses due to excessive floods or premature onset of the dry season.

APPENDIX TABLE I.—ALL RICE: AREA, YIELD, AND PRODUCTION
IN COLOMBIA BY DEPARTMENTS, 1954 AND 1963*

Department	Area (hectares)			Yield (kg. per ha.)			Production (tons rough)		
	1954	1963	Increase	1954	1963	Increase	1954	1963	Increase
Antioquia	7,800	8,600	800	1,103	1,541	438	8,600	13,250	4,650
Atlántico	150	450	300	1,333	1,778	445	200	800	600
Bolívar	29,000	27,000	-2,000	1,172	1,467	295	34,000	39,600	5,600
Boyaca	2,150	5,600	3,450	1,209	1,634	425	2,600	9,150	6,550
Caldas	4,500	5,800	1,300	1,711	2,121	410	7,700	12,300	4,600
Cauca	8,000	6,050	-1,950	2,088	2,471	383	16,700	14,950	-1,750
Córdoba	26,200	24,500	-1,700	1,126	1,629	503	29,500	39,900	10,400
Cundinamarca	5,000	8,000	3,000	2,060	2,325	265	10,300	18,600	8,300
Chocó	4,000	7,000	3,000	1,125	1,057	-68	4,500	7,400	2,900
Huila	7,500	13,800	6,300	2,933	3,428	495	22,000	47,300	25,300
Magdalena	6,400	17,500	11,100	1,812	2,209	397	11,600	38,650	27,050
Meta	20,000	33,200	13,200	1,105	1,694	589	22,100	56,250	34,150
Nariño	2,300	3,000	700	1,304	1,367	63	3,000	4,100	1,100
Norte de Santander	4,000	8,400	4,400	1,450	2,143	693	5,800	18,000	12,200
Santander	6,500	12,300	5,800	1,385	1,553	168	9,000	19,100	10,100
Tolima	24,800	43,500	18,700	2,990	3,241	251	74,150	141,000	66,850
Valle	9,000	13,300	4,300	2,733	3,090	357	24,600	41,100	16,500
Caqueta	3,200	11,000	7,800	1,094	1,768	674	3,500	19,450	15,950
La Guajira, Putumayo, Amazonas	5,000	5,000	—	1,000	1,820	820	5,000	9,100	4,100
Total	175,500	254,000	78,500	1,680	2,165	485	294,850	550,000	255,150

* Data for 1954 from Federacion Nacional de Arroceros, *Boletín de Estadística*, January 1958, No. 2, Quadro 10; for 1963 from Federacion Nacional de Arroceros, Sección Estadística, Estimativo de la Superficie cultivada y producción de arroz en cascara en 1963, por departamentos y sistemas de cultivo, unpublished.

APPENDIX TABLE II.—IRRIGATED AND UNIRRIGATED RICE: AREA, YIELD, AND PRODUCTION IN COLOMBIA BY DEPARTMENTS, 1954 AND 1963*

Department	Area (hectares)			Yield (kg. per ha.)			Production (tons rough)		
	1954	1963	Increase	1954	1963	Increase	1954	1963	Increase
IRRIGATED RICE									
Antioquia	300	600	300	2,000	2,583	583	600	1,550	950
Atlántico	—	150	150	2,000 ^a	3,000	1,000	—	450	450
Bolívar	—	1,000	1,000	2,000 ^a	2,450	450	—	2,450	2,450
Boyaca	150	600	450	2,000	2,333	333	300	1,400	1,100
Caldas	2,000	2,800	800	2,500	2,679	179	5,000	7,500	2,500
Cauca	6,500	3,550	-2,950	2,308	3,155	847	15,000	11,200	-3,800
Córdoba	1,200	1,500	300	2,083	2,267	184	2,500	3,400	900
Cundinamarca	4,000	5,500	1,500	2,250	2,909	659	9,000	16,000	7,000
Chocó	—	—	—	—	—	—	—	—	—
Huila	7,500	13,800	6,300	2,933	3,428	495	22,000	47,300	25,300
Magdalena	4,000	15,000	11,000	2,250	2,333	83	9,000	35,000	26,000
Meta	2,000	5,000	3,000	1,550	2,340	790	3,100	11,700	8,600
Nariño	500	—	-500	2,000	—	—	1,000	—	-1,000
Norte de Santander	1,500	5,200	3,700	2,000	2,769	769	3,000	14,400	11,400
Santander	1,500	1,800	300	2,333	2,444	111	3,500	4,400	900
Tolima	24,000	43,000	19,000	3,052	3,244	192	73,250	139,500	66,250
Valle	8,500	13,300	4,800	2,824	3,090	266	24,000	41,100	17,100
Caqueta	—	1,000	1,000	1,550 ^b	2,650	1,100	—	2,650	2,650
La Guajira, Putu- mayo, Amazonas	—	1,600	1,600	2,250 ^c	2,500	250	—	4,000	4,000
Total	63,650	115,400	51,750	2,690	2,981	291	171,250	344,000	172,750
UNIRRIGATED RICE									
Antioquia	7,500	8,000	500	1,067	1,462	395	8,000	11,700	3,700
Atlántico	150	300	150	1,333	1,167	-166	200	350	150
Bolívar	29,000	26,000	-3,000	1,172	1,429	257	34,000	37,150	3,150
Boyaca	2,000	5,000	3,000	1,150	1,550	400	2,300	7,750	5,450
Caldas	2,500	3,000	500	1,080	1,600	520	2,700	4,800	2,100
Cauca	1,500	2,500	1,000	1,133	1,500	367	1,700	3,750	2,050
Córdoba	25,000	23,000	-2,000	1,080	1,587	507	27,000	36,500	9,500
Cundinamarca	1,000	2,500	1,500	1,300	1,040	-260	1,300	2,600	1,300
Chocó	4,000	7,000	3,000	1,125	1,057	-68	4,500	7,400	2,900
Huila	—	—	—	—	—	—	—	—	—
Magdalena	2,400	2,500	100	1,083	1,460	377	2,600	3,650	1,050
Meta	18,000	28,200	10,200	1,056	1,580	524	19,000	44,550	25,550
Nariño	1,800	3,000	1,200	1,111	1,367	256	2,000	4,100	2,100
Norte de Santander	2,500	3,200	700	1,120	1,125	5	2,800	3,600	800
Santander	5,000	10,500	5,500	1,100	1,400	300	5,500	14,700	9,200
Tolima	800	500	-300	1,125	3,000	1,875	900	1,500	600
Valle	500 ^d	—	-500	1,200	—	-1,200	600	—	-600
Caqueta	3,200	10,000	6,800	1,094	1,680	586	3,500	16,800	13,300
La Guajira, Putu- mayo, Amazonas	5,000	3,400	-1,600	1,000	1,500	500	5,000	5,100	100
Total	111,850	138,600	26,750	1,105	1,486	381	123,600	206,000	82,400

* See Appendix Table I for sources.

^a Arbitrarily estimated at the level in Boyaca.^b Arbitrarily estimated at the level in Meta.^c Arbitrarily estimated at the level in Magdalena.^d Inferred from the national total shown in the source cited.

APPENDIX TABLE III.—PRODUCTION OF MAJOR FOODSTUFFS IN COLOMBIA,
SPECIFIED YEARS 1940-63*
(Thousand metric tons)

Product	1940	1945	1950	1955	1959	1961	1962	1963
Maize	590	618	620	940	850	...	754	782
Sugar								
Panela ^a	699	624	646	...	590	774 ^b	...	...
Centrifugal	48	76 ^o	147	144	250	362	369 ^d	339 ^d
Rice, rough	88 ^o	96	242	320	422	474 ^f	585 ^f	550 ^f
Plantain	960	738 ^o	942	1,048	1,130	...	...	...
Potatoes	444	448	360	665	900	...	872	572
Wheat	125	82	102	150	180	...	170	90
Barley	7	23	38	52	105	...	80	...
Beans	36	60	26	65	60	...	48	44
Chick-peas	...	23	25	22	26	...	24	25

* Except as otherwise noted data for 1940 from Guillermo Palacio del Valle, *Desarrollo Agrícola de Colombia 1940-1952* (Ministerio de Agricultura, July 1963); for 1945-59 from "Investigación y Fomento," *Agricultura Tropical*, November 1959 (Bogotá), p. 815; and for 1962-63 from Instituto Nacional de Abastecimiento, *Producción, Consumo y Faltantes de Productos Básicos, Años 1962-1963-1964* (Bogotá, April 1964).

^a Noncentrifugal raw sugar.

^b V. U. Izquierdo, *Caña, Trapiches y Panela en Cauca, Valle, Caldas, Cali* (Asociación Nacional de Cultivadores de Caña de Azúcar, Cali, 1964), p. 21.

^c From source cited above for 1940.

^d From "Producción de Azúcar, 1962-1964," Colombia, Departamento Administrativo Nacional de Estadística, *Boletín Mensual de Estadística*, August 1964, p. 23.

^e From "Desarrollo de la Producción de Arroz en Colombia," *Arroz*, Vol. IX, No. 105, 1960, p. 16.

^f Unpublished data of the Federación Nacional de Arroceros.

APPENDIX TABLE IV.—COMPARISON OF AVERAGE AND MAXIMUM PRODUCER PRICES OF
ROUGH RICE AND MAIZE IN TOLIMA AND BOLÍVAR, SPECIFIED MONTHS, 1959-64*
(Pesos per arroba, except as otherwise indicated)

Year and month	Tolima						Bolívar					
	Rough Rice			Maize			Rough Rice			Maize		
	Average	Maximum		Average	Maximum		Average	Maximum		Average	Maximum	
		Over average	Per cent of average		Over average	Per cent of average		Over average	Per cent of average		Over average	Per cent of average
1959												
February 15	9.50	0.50	5.3	6.50	2.0	30.8	6.00	1.00	16.6	3.50	1.50	42.9
April 15	10.60	1.10	10.4	7.25	1.25	17.2	6.50	1.00	15.4	5.75	1.75	30.4
June 15	10.75	0.75	6.98	7.75	2.75	35.5	8.75	1.25	14.3	7.15	1.65	23.1
August 15	11.00	1.00	9.9	9.00	2.00	22.2	7.50	2.50	33.0	6.00	3.00	50.0
October 15	10.00	2.00	20.0	7.45	1.55	20.8	6.62	1.62	24.5	5.00	1.00	20.0
December 15	10.00	2.00	20.0	6.75	1.75	25.9	6.75	1.75	25.9	5.00	1.50	30.0
1960												
February 15	10.25	0.25	2.4	6.50	1.50	23.1	8.25	1.75	21.2	5.50	1.50	27.3
June 15	10.50	0.50	4.8	5.75	1.75	30.4	9.00	1.00	11.1	6.25	1.25	20.0
August 15	9.50	1.00	10.6	6.50	1.50	23.1	10.00	2.00	20.0	6.00	2.00	33.0
1961												
February 15	10.50	0.50	4.8	9.00	1.00	11.1	9.00	1.00	11.1	6.87	1.87	27.2
April 15	12.00	1.00	8.3	8.50	2.50	29.4	9.50	1.50	15.8	9.25	1.75	18.9
June 15	12.25	0.25	2.0	11.75	3.75	31.9	11.00	2.00	18.2	9.00	2.00	22.2
August 15	12.25	0.25	2.0	10.50	2.50	23.8	10.50	1.50	14.3	8.25	1.75	21.2
October 15	—	—	—	9.50	2.50	26.3	10.50	2.50	23.8	8.00	2.00	25.0
1962												
February 15	10.50	1.00	9.5	8.50	2.50	29.4	8.75	2.25	25.7	6.00	2.00	33.0
June 15	10.50	1.00	9.5	8.50	2.50	29.4	8.75	2.25	25.7	6.00	2.00	33.0
August 15	9.75	2.25	23.1	7.00	2.00	28.6	10.00	3.00	30.0	7.50	2.50	33.0
October 15	9.50	1.50	15.8	7.50	2.50	33.0	6.75	1.75	25.9	5.75	1.75	30.0
1963												
February 15	9.50	1.50	15.8	10.50	2.50	23.8	7.00	2.00	28.6	3.75	1.25	33.0
April 15	12.00	2.00	16.6	11.00	4.00	36.4	10.50	1.50	14.3	6.50	1.50	23.0
June 15	13.00	2.00	15.4	13.50	3.50	25.9	10.50	1.50	14.3	7.50	2.50	33.0
August 15	13.50	1.50	11.1	12.00	3.00	25.0	10.00	1.00	10.0	8.50	1.50	17.6
1964												
February 15	14.50	3.50	24.1	16.50	4.50	27.3	12.50	2.50	20.0	10.50	1.50	14.3

* Data from Caja de Crédito Agrario, Industrial y Minero, *Boletín de Información Agropecuaria*, various issues 1959-64 (Bogotá). One arroba equals 12.5 kg.

APPENDIX TABLE V.—WHOLESALE PRICES IN BOGOTÁ FOR MAJOR FOODSTUFFS,
AND SPECIFIED NATIONAL INDEXES, 1945-64*

Year	Pesos per arroba					Pesos per carga		Indexes, 1952 = 100	
	Rice		Maize, amarillo porva	Potatoes sabanera primera	Wheat 1st	Plantain, ripe	Sugar, non-cen- trifugal ^a	Means of pay- ment	Cost of living
	1st	3rd							
1945	5.35	4.05	1.88	3.19	4.49	12.50	30.00	37.4	41.1
1946	5.28	3.84	2.22	3.42	4.33	12.25	29.25	46.7	52.0
1947	7.10	5.56	3.19	3.51	5.45	15.75	35.33	48.9	63.5
1948	7.56	6.62	3.22	3.97	7.53	17.92	30.25	54.8	73.3
1949	7.53	6.84	3.08	3.81	7.39	17.50	30.58	63.0	76.6
1950	9.55	8.43	4.63	6.58	9.91	20.17	33.83	76.6	97.9
1951	13.52	11.40	4.79	5.67	9.87	21.83	36.83	79.8	106.6
1952	11.33	7.72	3.70	4.56	10.51	23.54	48.44	100.0	100.0
1953	12.56	8.05	4.90	5.39	10.43	23.38	56.27	112.2	109.8
1954	14.44	9.11	7.29	5.87	11.63	31.66	54.31	136.4	121.9
1955	13.31	6.72	7.06	4.61	10.83	31.18	49.27	150.8	116.7
1956	13.53	8.55	7.46	6.19	11.51	32.33	49.08	169.2	128.1
1957	17.74	12.65	9.20	6.36	12.44	40.52	93.34	203.0	160.9
1958	20.07	12.43	11.33	7.34	14.71	42.76	122.99	236.4	176.8
1959	20.72	13.83	11.29	6.80	15.00	54.52	113.75	276.5	185.1
1960	23.07	14.20	9.36	7.08	14.63	50.73	93.01	293.6	195.0
1961	25.47	18.49	13.35	9.91	15.62	67.18	84.72	344.0	216.0
1962	24.31	12.78	13.21	7.09	15.53	74.73	125.44	407.4	213.4
1963	27.00	16.53	15.80	13.09	17.56	98.88	211.82	549.9	280.4
1964	32.17	26.02	30.24	18.96	25.66	...	251.52	642.3	368.7
Indexes									
1945 = 100									
1961	476	457	710	311	348	537	282	920	526
1964	601	642	1,609	594	571	...	838	1,717	897

* Data for food prices from Colombia, Departamento Administrativo de Estadística, *Anuario general de estadística*, 1956, p. 297; *ibid*, 1963, p. 490; and its *Boletín Mensual de Estadística*, various issues. Means of payment and cost of living indexes (prices of 15 foodstuffs), from *Revista del Banco de la República*, February 1966, pp. 127, 129. One arroba equals 12.5 kilograms, and one carga equals 125 kilograms.

^a Fusagasugá type, 1st quality.

APPENDIX TABLE VI.—LAND RENT AND LAND PRICES IN THE COELLO AND SALDAÑA IRRIGATION DISTRICTS, SPECIFIED YEARS, 1948-63*

Year	Current pesos				1952 pesos		U.S. dollars	
	Coello		Saldaña		Coello	Saldaña	Coello	Saldaña
	Range	Average	Range	Average				
			RENT PER HECTARE ^a					
1948	...	...	25-50	38	...	51	...	20
1950	30-100	65	...	...	66	...	26	...
1959	400-550	475	...	350 ^b	257	189 ^b	102	75 ^b
1963 ^c	500-800	650	500-800	650	232	232	92	92
			PRICE PER HECTARE					
1948	500-600	550 ^a	...	300	750 ^a	409	299	163
1950	...	800	...	600	817	613	325	244
1951	...	...	...	1,500	...	1,407	...	561
1953	2,000-3,000	2,500 ^a	...	...	2,277 ^a	...	907	...
1959	...	5,000	...	3,500	2,701	1,891	1,076	753

* Data in current pesos for rent in 1948 from Instituto Colombiano de Reforma Agraria (INCORA), *Consideraciones sobre una política de irrigaciones en Colombia* (Consejo Social Agrario, Primera Reunión, April 17-22, 1963, Doc. 9, Bogotá); for rents 1950 and 1959 and for land prices in Coello 1950 and 1959 and Saldaña 1959 from Caja de Crédito Agrario, Industrial y Minero, *Informe financiero económico y social sobre el estado actual de los distritos de irrigación de Coello y Saldaña en el Tolima* (Bogotá, 1960); and for rents in 1963 from the latter agency's *Informe de gerencia, 31 de Diciembre 1963* (Bogotá, 1963). Land prices, except those specified above, from *Arroz*, Vol. X, No. 110 (Bogotá, 1961). Average data in 1952 pesos have been computed using the price index for 15 foodstuffs in Appendix Table V; and in U.S. dollars at the 1952 exchange rate of 2.51 pesos per dollar.

^a Averages are means of ranges except as indicated in note *b*.

^b Minimum.

^c Figures from the main semester only; many fields are in pasture every other semester.

APPENDIX TABLE VII.—PERCENTAGE INCREASES IN SIGNIFICANT VARIABLES FOLLOWING IRRIGATION IN COELLO AND SALDAÑA, FROM 1950 TO 1958/59, AT 1959 PESO PRICES*

Variables	Coello	Saldaña
Increase in acreage dedicated to crop farming	90.54	354.55
Increase in total acreage dedicated to both crop farming and cattle farming	21.54	125.80
Increase in gross income per hectare harvested	123.05	192.12
Increase in total gross income derived from crop and cattle farming	151.76	544.27
Increase in land rentals		
Total	143.10	602.96
Per hectare harvested	104.39	213.58

* Data from INCORA, *Consideraciones sobre una política de irrigaciones en Colombia* (Consejo Social Agrario, Primera Reunión, April 17-22, 1963, Doc. 9, Bogotá).